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The Journal of

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

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VOL. 10, No. 2 JUNE, 1944

Technical Efficiency in the Rural Industries

The following report on Technical Efficiency in the Rural Industries was submitted to the Rural Reconstruction Commission in March, 1944, at the request of the New South Wales Branch of the Institute. It was compiled from the prepared statements of many specialist members of the Branch who consulted workers in the same or closely related fields. The committee appointed by the Branch to coordinate the work and compile the report consisted of Messrs. W. H. Pawley (convener), F. J. Jeffery, H. B. Carter, W. Poggendorff and Dr. F. T. Bowman.

Agricultural Education.

Agricultural education is at the very roots of agricultural efficiency. The underlying aim of agricultural education must be the elevation of the farmer's efficiency, his dignity and self-respect to a point where the farming industries compare favourably in technical and cultural development with all other industries.

The solution of many problems considered here is already being attempted by the appropriate State instrumentalities, but a much stronger and more sustained effort is required of them to make effective a higher degree of technical efficiency throughout the agricultural industries. The suggestions set out in the following sections demand the provision of adequate funds for the proper functioning of the educational services and a satisfactory standard of living for farmers and farm workers.

The Department of Education.

There should be a properly graded system of agricultural education, commencing with the primary school and terminating in technical colleges, so that in the first place children might be taught to take an interest in rural life and get to know something of technical details of the occupation, and in the second place those who have been attracted by the land might be given a sound technical training for their chosen vocation.

(*a*) *General Division.*—Nature study in rural primary schools should be so organized as to give a bias towards agricultural aspects. This would help to bring the pupil into harmony and sympathy with his or her environment. Whilst the present syllabus in nature study is intended to bring about this result, more assistance should be given teachers in their training and in their teaching to ensure that the instruction given achieves the purpose intended. The coordination of school work and Junior Farmer Club activity is strongly recommended.

Agricultural subjects should be taught in all country high schools. Such schools should teach, at least, the principles of plant and animal life to all pupils, thus assisting further in establishing a real interest in agriculture as a way of life.

(*b*) *The Technical Education Branch.*—Part-time courses designed to meet the technical requirements of the man on the land should be introduced in the technical education system now rapidly spreading through the country centres. Much can be done by encouraging suitable boys to look to the land for their life's work, as is the case with lads in other callings, by arranging for their attendance at technical colleges for supplementary courses of instruction. To support this work some sort of apprenticeship system is required.

The present organization of rural correspondence courses could be extended to provide instruction in a wide range of special subjects such as vegetable growing, fruit growing, bee keeping, farm records, etc. Such courses should be regarded as a means of educating people who are unable to attend oral instruction.

Agricultural instructors of the Department of Agriculture should be used on a part-time basis in the teaching of technical college courses.

(*c*) *The New South Wales Junior Farmer Clubs.*—Emphasis is placed on the value and importance of this organization. Suggested measures for assisting the movement are (i) appointment of additional supervisors, and (ii) increased assistance from the Department of Agriculture.

The Department of Agriculture.

The chief aim of the extension service of the Department of Agriculture should be to keep farmers up to date and enable them to meet changes in demand.

The extension service should provide opportunity for social intercourse in the farming community by the organization of discussion groups, the establishment of an adequate library system, development of the community and cooperative spirit. The future success of extension workers is bound up with improved methods to stabilize prices of primary products, the income of individual farms and with the compensation of farmers for adopting long-range improvements of a national character. The recommendations made are as follows:

1. Greater utilization of experiment farms for instruction and decentralization of scientific research.
2. Increased assistance to the Agricultural Bureau and Rural Societies.
3. Improved service in extension literature.
4. Steps should be taken to increase the influence of the *Agricultural Gazette*.
5. Improved technique in the preparations of extension literature for the consumption of the farmer on the one hand, and the extension officer on the other.
6. Greater and more expert use of the radio should be made.
7. Refresher courses for extension workers should be conducted.
8. Field officers should receive special training in extension methods.
9. The appointment of additional properly equipped extension officers, some to assist the Agricultural Bureau and field officers, chiefly by the better organization of school conferences and discussion groups; others to provide a liaison between the extension service and specialized branches of the Department of Agriculture and other organizations. The latter would collect and prepare technical information for issue to extension officers and to press and radio.
10. Ideally, extension services throughout the Commonwealth should be linked together.

The University.

The question of decentralization of university education should be considered. Provision should be made, where possible, for university courses in country centres, so long as the efficiency of courses established in Sydney is not impaired.

Decentralization of education in the agricultural degree course could not be justified at this juncture, but the opportunity should be taken as soon as possible of introducing courses in rural sociology and developing rural economics, and consideration should be given to their establishment in Branch University Colleges. This decentralization would assist in improving the amenities in country centres.

The practical training in agriculture given to university students should be improved by either (*a*) establishing a university farm, or (*b*) by making arrangements with some suitably equipped commercial farm, or (*c*) by having existing experiment farms reorganized to serve this purpose, or (*d*) by making use of some suitable combination of these methods. The University should give increased attention to vegetable culture and horticultural subjects. Students who have elected to do post-graduate work on a particular branch of agriculture should be able to study

in the State where this branch is best developed. The University should provide refresher courses in any specialized branch of agriculture for which its staff is suitably equipped.

Fruit and Vegetable Industries.

With perishable products like fruit and vegetables, efficiency in the industry depends as much upon the ways by which the crop is handled and disposed of after harvesting as upon the methods by which it is grown. Not only are considerable improvements in handling of the fresh produce required, but it is desirable that as much as possible of the perishable products should be converted to a less perishable form, in order to iron out seasonal fluctuations, promote consumption and have a general stabilizing influence on the industries. The fostering, by extension and research, if not by administration, of suitable handling and preservation inevitably means more specialization on the crops most suitable for the various districts and the organization of handling by centralized packing houses and/or processing plants. For the most economic working of the plants, it is apparent that fruit and vegetable growing should be closely associated in at least some districts.

Preservation.—The desirable improvements in harvesting are largely a matter of putting existing knowledge into everyday practice.

A general improvement in packing is required, and can best be done by the development of central packing houses where the fruit and vegetables can be well cleaned, well graded and put up in standard lines, and where fungicidal washes, controlled ripening and like treatments are best carried out.

Transport should be greatly improved by the adoption of refrigerated cars for perishable and louvred vans for less perishable products.

Modern up-to-date cool stores and gas stores are urgently needed. Common storage can be used rather extensively in cool Tableland areas for waxed hard vegetables and apples, during winter and early spring.

Canning and drying and other processes for various fruits and vegetables will undergo a general extension and improvement on the pre-war situation. For maintaining in the post-war period much of the present developments in canning, the main vegetables to which attention should be given are corn, tomatoes, peas, asparagus, lima beans, green beans, beet, carrots and cabbage. Sun drying of cut fruits and prunes should be replaced by dehydration. In the final product a general lowering of moisture content and increase of sulphur content is desirable to improve keeping quality. Spray drying of fruits and vegetable products is a new and promising method.

It would be advantageous to adopt quick freezing for certain products, those especially suitable being berry fruits, pineapples, paw paws, peas, corn, broccoli and beans.

Technical efficiency in various fruit and vegetable industries requires the establishment of juice production as well as suitable by-products manufacture.

Vegetable growing.—On account of the great increase in production which is taking place during the war, it is obvious that positive steps should be taken in the post-war period to adjust production to the requirements of that time. For the nation to avail itself permanently of as much as possible of the present increase in vegetable production, arrangements should be made for its marketing and distribution. Effective distribution can be obtained only if vegetables are available in the processed as well as fresh forms. It will be necessary to foster the vegetable-canning industry and probably quick freezing, to introduce rail refrigeration and to improve storage facilities.

Facilities for vegetable growing should be developed in certain main areas. Greater use of irrigation is essential, requiring the construction of dams or, on coastal rivers, of weirs to exclude tidal salt water. The main areas are Metropolitan and Hawkesbury River, Hunter River, Moss Vale and Southern Tablelands, Murrumbidgee Irrigation Areas, Parkes and Menindee.

Vegetable seed production should be continued and expanded, if necessary by subsidy payments, and a system of official recommendation and certification greatly extended, preferably on uniform lines throughout the Commonwealth and New Zealand.

Fruitgrowing.—In the main coastal citrus growing areas, it would be advantageous to encourage orange juice production on account of the poorer keeping quality and appearance of fruit from this area compared with inland oranges, the facts that Valencia preponderates, and that the fresh fruit is under an embargo for export to New Zealand. Considerable research and extension are necessary in this area on soil fertility and soil conservation, as well as on Black Spot control.

On the Murrumbidgee and Murray Irrigation Areas, the production of citrus will be greatly improved only by the arrest of the condition of citrus decline in established groves and the greater use of resistant stocks in new plantings. The efficiency of future production will depend also on the selection of lighter soils which are most suitable for citrus growing under irrigation, improved cultural methods for irrigated soils and the proper control of pests, especially Red Scale. The quality of the fruit recommends its principal use as being for fresh fruit.

In dried vine fruits, efficient methods have been evolved, and largely put into practice of producing a high quality product which, up to the present, has depended on Empire preference. Yields can be improved, without loss of quality, by fertiliser, and methods of bringing about a more uniform production from year to year should be explored.

Pome fruit production for local requirements should be increased. The increase should be confined to the more reliable, well recognized Tableland areas, using a limited number of well established commercial varieties. As the production in these areas is mainly of late apples for storage, there is room for increased production in earlier districts of " summer " apples. It will be necessary to avoid " marginal " districts in which production has declined in recent years.

Prune plantings should be carried out to maintain present areas, and expansion can be advocated on suitable land in safe districts. In the Murrumbidgee Irrigation Areas the adoption of measures to overcome poor cropping of Robe prune and the premature dropping of d'Agen is capable of considerably increasing production per acre. To enable the more extensive use and economical operation of dehydration, which gives a superior product to sun drying, it may be desirable to extend apricot and peach growing for drying purposes in existing prune-growing areas.

Regarding peaches, apricots and pears for canning, care will need to be exercised to ensure that the present production is maintained to enable established canneries to work to capacity.

Cherry growing presents limited scope for expansion for both fresh fruit and the crystallising trades. In planting, every care should be taken in the selection of the district and the land. Increases in acreage production would result in many instances, by improving the cross pollination facilities in existing orchards. Other soft stone fruits (peaches, apricots and plums) are well planted up.

Tree nuts should be considered for expansion in view of the fact that large importations are made of nuts and nut products, and there are inland irrigated areas where they can be economically produced. With almonds, walnuts, the pecan and Australian nuts, the selection of suitable climate and suitable varieties is necessary to efficient production.

There does not appear to be any reason why the whole of Australia's requirements of olive oil and pickled olives could not be economically produced in the Commonwealth. Imports in 1938-39 were valued at £90,000. It may be necessary, however, for the Government to provide financial assistance to tide growers over the lengthy non-bearing period, and to enable the erection of oil extraction factories.

Owing to improved cultural and manurial practices now available, the growing of bananas, at one time confined to virgin mountain country, should be extended to less precipitous country previously used in some instances for grass and cane. Beans may be used to supplement income in the early years, and when the bananas become unprofitable beans can be again used to rejuvenate the land. There is scope for the extension of papaw, mango and pineapple growing and the cultivation of avocados is increasing, in association with banana growing.

Field Crops.

Wheat.—It is considered that the efficiency of the wheat-growing industry could be increased by attention to the following points:

1. The production of soft biscuit wheats in certain parts of the State. Such wheats would have to be grown and marketed separately from other types.
2. The elimination of the softest wheats for export, and consequent improvement of the F.A.Q. standard.
3. Production and separate marketing of a " Hard White Australian " type of wheat for export, in addition to a class rather similar to the present F.A.Q.
4. Breeding of disease resistant varieties better suited to specific uses and localities. These include:
    - (*a*) Green fodder varieties for Coastal districts, which would assist the livestock industries.
    - (*b*) Soft (biscuit) varieties for the Tablelands and parts of the nearer slopes.
    - (*c*) Varieties possessing high baking quality for parts of the Slopes and Plains.
    - (*d*) True " winter wheats " to extend sowing and grazing periods.

Oats.—This crop could play a very important part in increasing the efficiency of rural industries through :

1. Increased production of oaten grain especially to obtain a higher food value for a given amount of labour, and to economise transport and materials.
2. In the form of stored grain as one of the best provisions against drought. Bulk storage facilities are necessary on the farm.
3. Increased use as pasture to stabilize dairying on the Coast and Tablelands, reduce sheep losses on the Tablelands during winter and improve spring lamb production on the Slopes. On the Coast particularly, this extension of oats as pasture must be correlated with better facilities, such as cooperatively owned and operated mechanized units in order to enable small dairy farmers to grow green fodder crops.
4. Providing a practical alternative to wheat in the rotation.
5. Exploitation of a potential export market for hulless oats.
6. Provision by breeding of more suitable varieties for all districts, with rust and smut resistance and good grazing qualities.

Barley.—Greater production and local use of feed barleys is advocated, but adequate storage facilities must be provided for barley grain. The production, by breeding, of more disease-resistant and stronger-strawed varieties would extend the usefulness of barley.

Rye.—This crop could be used much more extensively to extend the quantity of green fodder produced on poor soils and in less favoured districts.

Fodder Crops.—Fodder crops, in the form of stored fodder, must play an increasingly important part in insuring against drought and in stabilizing production. Among the means whereby greater fodder production and storage could be brought about are :

1. Consideration should be given to the payment of subsidies on fodder stored, or on construction of means of storage.
2. Consideration might be given to whether the Government might assume responsibility for production and storage of fodder in some districts.
3. Fodder production and storage could be encouraged by the use of Government or cooperatively owned balers and other machinery.

Rice.—The efficiency of rice production could be increased by the provision of stronger-strawed varieties of the short grain type in use, to which some of the cooking quality of the long-grain types might be transferred by breeding.

Linseed.—The persistence of this crop after the war is largely dependent on the provision of disease-resistant varieties with the yielding ability and quality of the Indian types. Efficient production of linseed will involve the development of economic large-scale methods of insect pest control, such as the airplane dusting of cotton and other crops practised in U.S.A.

Miscellaneous Crops.—The efficiency of rural industry could be increased by the economic exploitation of certain crops such as tung, peppermint, ramie, sunn hemp, pyrethrum and buckwheat, to produce materials which are normally imported.

Crop Rotation.—The question of crop rotation, including the use of sown pastures, is intimately associated with both soil conservation and the livestock industries. Areas sown to pasturage in wheat districts should be increased considerably. A great educational campaign is necessary to bring to the notice of farmers generally the benefits of growing pastures and fodder crops in rotation with soil depleting crops. Experience in U.S.A., where acreage bonus payments have been made, would suggest that a similar subsidy method might be used as an inducement to the maintenance of soil fertility as a national asset.

Machinery.

It is strongly recommended that a farm machinery research and testing organization should be set up under Federal control, with the State Department of Agriculture represented. The functions of this body would include the impartial testing of different makes of machines, the standardization of machines and parts to reduce cost of production, the testing and possible purchase of patents and advice to manufacturers and users on all phases of machinery usage.

Cooperative ownership and contract operation of farm machinery, on the model of present machinery pools and schemes in the dairying industry should be extended.

Courses in farm machinery are needed. These should be improved or initiated at technical colleges, Hawkesbury Agricultural College and agricultural high schools.

Grassland and Lucerne Farming.

Grassland farming is not practised to anything like an adequate extent in New South Wales. The total area of holdings on the coast, tablelands and slopes amounts to over sixty million acres, but less than two million acres are under sown or top-dressed pastures or lucerne, if one excludes the naturalized paspalum on the coast. With this situation in mind it is worth while to summarize the more evident difficulties of our " natural " grassland, as follows : (*a*) natural grass species are of low carrying capacity generally, and in dairying districts in particular are of little value for milk production ; (*b*) clover deficiency is characteristic and due principally to this the soils lack organic matter and are becoming increasingly liable to react unfavourably to dry periods. Erosion risk is increasing ; (*c*) with few exceptions, the soils of the principal grazing areas are deficient in essential minerals ; (*d*) pastures on wheat farms have deteriorated considerably because of continued cropping over long periods without adequate measures to maintain soil fertility.

The remedial measures necessary depend somewhat upon whether the area under consideration is on the coast or inland.

On the coast the principal factors contributing to the lower standard of grass farming are as follows :

1. The comparatively large unit areas in districts of safe rainfall. Frequently, dairy production is maintained by the cultivation of fodder crops of perhaps 30 to 60 acres on creek frontage, inferior grassland being subdivided into large paddocks which are little more than rest areas contributing practically nothing towards the maintenance of the herd. Most of this inferior land is capable of vast improvement.
2. The undeveloped condition of many holdings. A great deal of clearing is often a necessary preliminary to grassland operations, and lack of both time and money stand in the way.
3. Inadequate subdivision of properties. Subdivision must be the initial step in grassland improvement. It facilitates management and the efficient utilization of droppings.
4. Absence of suitable machinery for clearing work. Certain machinery now employed in war activities could be transferred to coastal districts in the post-war period to be operated under the contract system in the clearing of land. This would greatly lessen capital costs.
5. High cost of seeds.
6. Absence of a financial scheme specifically designed to help the farmer over the initial capital costs—clearing, subdivision, seed, fertiliser and lime.
7. Debt burden. Many farmers are unable or unwilling to incur further liabilities to proceed with developmental work.
8. Insufficient knowledge on the part of the farmer of developments in agricultural practice, e.g. the benefits of topdressing with superphosphate and the use of lime are inadequately appreciated. Intensive advisory work is needed during the post-war period.

A major problem inland is lack of suitable financial accommodation to tide the farmer over the critical period between the commencement of operations and the realization of profitable returns. This period may be lengthy owing to (*a*) the uncertain rainfall in many of the districts is often responsible for the process of clover introduction being slow and costly ; and (*b*) in many instances the fertility of the soil has been removed by several generations of grazing animals, and it is sometimes necessary to continue treatment with superphosphate for five or six years before operations reach a profitable stage.

Financial institutions, guided largely by reports from their field officers, will often withdraw support at a critical time. A better basis, from the farming and national viewpoints, for providing financial accommodation would be a certificate from a pasture specialist of the Department of Agriculture that the project was financially sound.

Soil fertility would be greatly improved by growing lucerne and clovers in rotation with cereal crops. A subsidy system after the style of the " Triple A " in the U.S.A. for encouraging sound farming practices will probably be the most competent means of solving the grassland problems of wheat and other crop farmers.

By way of preparation for post-war improvements the grass and clover seed industry should be encouraged during the war period, and the provision of finance for the installation of harvesting and cleaning machinery at approved centres might be considered.

Weeds.

Though much has been done, our present knowledge even of our most important weeds is exceedingly limited. In the case of certain serious weeds a dead-end as to methods of control has been reached until essential information has been obtained. The main deficiencies may be grouped broadly as (*a*) the exact distribution and density of infection of our lands is not known ; (*b*) losses caused by weeds as well as their redeeming features are not well understood. On this knowledge must depend broad policy in eradication or control ; (*c*) basic knowledge of growth habits, physiology and plant sociology is in most cases lacking. On this must depend methods of eradication or control ; (*d*) the sources of infection and the resistance of certain important weeds is not well known.

Further technical developments in weed control must therefore be built on a sound basis of research in the following directions :

1. Field surveys of economically important species.
2. Physiological studies (e.g. seed viability, plant metabolism, root studies, etc.).
3. Weed sociology in plant communities.
4. Anatomy and morphology studies.
5. Life histories with special emphasis on reproduction.
6. Sources of infection.
7. Studies on the correct identification and early (seedling) recognition of serious weeds.

The organization in N.S.W. to develop such a programme of research and to coordinate knowledge on methods of control and eradication should be based on a standing Committee on Weeds. This committee, it is suggested, should consist of the following officers of the N.S.W. Department of Agriculture : the Chief Botanist, the Chiefs of the Division of Science Services and Plant Industry, and the Principal Weeds Research Officer, with powers to co-opt the Professor of Botany, University of Sydney, and others as required. It is emphasized that the work should be carried out by the N.S.W. Department of Agriculture under the direction of the Chief Botanist and that two additional botanists should be appointed for the work.

Tree Planting on Farm and Pastoral Areas.

Trees have a wide general usefulness on farm and pastoral areas, but their principal functions are to provide timber, and shelter for stock and crops. Landholders, as a whole, appreciate those facts, but the many unsatisfactory features of the situation may be summarized as follows : (*a*) A large proportion of farm and pastoral areas require some form of tree planting, either for shelter or to provide timber and fuel. Very little has been done regarding really efficient plantings. (*b*) Apart from planting, there is good scope for conservation and regeneration work, especially as regards tree lots. (*c*) A fair amount of useful information is available concerning tree planting work, but there is a great deal of room for further investigation, especially as regards suitable species for different districts, planting distances, windbreak formations, and the technique of tree lots. (*d*) The obtaining of young plants and seeds is hedged about with quite a number of difficulties. Some very suitable species are not stocked by nurserymen, and in some cases at least the cost of young stock discourages the landowner. Seed is difficult to obtain by people who wish to raise their own stock.

Should tree planting programmes be given the position which they merit in post-war reconstruction, then the following recommendations are made :

1. An officer should be appointed whose sole duties would be to investigate tree-planting work. Such officer should be under the control of the Chief Botanist, but should be in close touch with the extension work of the Department of Agriculture, and with the Forestry Commission and the Soil Conservation Service. He should investigate all aspects of tree planting and tree conservation, including the introduction of new species.
2. Some provision should be made to ensure that land-owners could obtain suitable plants and seed at the lowest possible price, and in the best condition for successful planting.
3. The land-owner should be instructed regarding the benefits to be gained from tree planting, and should be provided with the necessary advice and plants to carry out his programme.

Sheep and Wool Production.

Since the sheep contributes three products—wool, meat and skins—the ideal of the " economic sheep " for any particular environment with the best balance in these three directions is to be pursued. Technical efficiency to this end can be attained only with a background of (*a*) adequate education on the part of the producer and a proper understanding of market requirements ; (*b*) properly trained and educated technical advisers ; and (*c*) an active and well-organized Department of Agriculture with suitable extension services closely linked with appropriate centres of fundamental research.

The main fields for technical improvement are :

1. Control of economic loss by disease. This is a function of the Veterinary Service and is largely covered by a report from the Australian Veterinary Association.
2. The maintenance of a stable and adequate plane of nutrition. This is necessary alike to the production of meat and wool. It depends in part on adequate disease control but mainly on pasture and crop management. Special attention here must be given to (*a*) conservative stocking, (*b*) fodder conservation, (*c*) general pasture management, and (*d*) the supply and use of emergency supplements (e.g. protein and mineral).
3. The development of the most efficiently productive strains of sheep for wool and mutton. The main avenues offering scope in this field are :
   (*a*) Improvement by constructive breeding, especially developing the progeny test and the use of artificial insemination.
   (*b*) Improvement of methods in animal husbandry.
   (*c*) Revision of show and breed society standards and methods.
   (*d*) Cooperative ram circles for small farmers.
   (*e*) Development of testing services for the animal breeder.
4. Organization. The foundation of any attempt at technical improvement should be the development of district or regional animal production centres under the ægis of a Federal department of agriculture. Each such centre should consist of a closely knit team comprising a district veterinary officer, a district agricultural officer and a district animal husbandry officer, each of equal status with an appropriately balanced staff of specialists. Problems of sheep and wool production would form one field of many under such a scheme. This and other sections ought to be considered in close relation to recommendations in the report of the Australian Veterinary Association on the Veterinary Services and Rural Reconstruction.

It is to be noted that the main recommendations put forward here are also of more general application in principle to the other animal industries (dairying, beef cattle, pigs) with which they must inevitably be considered under any scheme of reorganization.

Dairy Industry.

The dairy industry as a whole is not prosperous. Until economic stability on the basis of reasonably sure and sound prices for dairy products is established and general living conditions on the farm improved, then technical efficiency must inevitably lag, since the incentive for improvement is not present. The industry is continually struggling against the drift of farmer's sons and daughters to better paid work in secondary industry because of the general lack of reasonable living conditions on the farm and the long and arduous working hours. Income is limited by (*a*) high capital valuation of property and rates of interest, and (*b*) low production of the milking herd, due largely to inadequate feeding. Low production (*b*) is, in part, the result of (*a*) since failure to provide the feed requirements of the dairy cow can be regarded as a consequence of (i) the present system of leasehold tenure, which does not encourage the lessee to make improvements at his own expense,

nor the owner, since the rental value is often his only source of income. (The "Agricultural Holdings Act, 1941" may help to overcome this situation); (ii) high rents; (iii) lack of labour-saving devices. (The present cooperative mechanization scheme now operating in parts of N.S.W. and the big increase in the number of milking machines may help here.) Fluctuating seasonal conditions, however, present the main obstacles to higher production which must be overcome in feeding the dairy herd.

The principal recommendations made here for the improvement in efficiency of dairy production and the quality of dairy products are as follows:

1. The wider application of existing agricultural extension services.
2. An improvement in the education and general training of recruits for admission to the Government services connected with dairying.
3. Extended supervision of farm dairies and dairy factories.
4. The development and extension of a uniform herd recording system, especially for registered pure-breds, in all States.
5. The introduction of Bull Licensing Acts in all States.
6. The establishment of a central experiment station (e.g. at Hawkesbury Agricultural College) for the study of new methods and new machinery in dairy factories.
7. The general improvement of living conditions for the dairy farmer and his family (e.g. reticulated water systems, electricity, better housing, etc.).

Pig Production.

Compared with most of the prominent pig producing countries with the possible exception of New Zealand, Australia possesses perhaps the most favourable environment for this animal industry. Contrary to general opinion the limiting factor to expansion is not any shortage of protein concentrates.

The main recommendation made is a plea for the more effective application of the known principles of pig nutrition since there is no real shortage of suitable foodstuffs. The main points to which special attention is directed are as follows:

1. The more efficient use of skim milk and other dairy by-products.
2. In association with (1) above, an increase in the grain feeding of pigs in dairying areas.
3. The increased development of pig raising in suitable grain producing, as distinct from dairying, districts. This will require the development and use of suitable protein supplements not of dairying origin, e.g. meat meal, linseed meal, peanut meal, coconut meal, cotton seed meal, lucerne meal, and when circumstances warrant it old sheep could be used.

Egg and Poultry Industry.

Present deficiencies in this industry fall under two main heads: (*a*) those deficiencies limiting the efficient development of the industry which can be repaired from existing knowledge, and (*b*) those deficiencies requiring further research for their solution.

Under the former head the following points are outstanding:

1. Size of Farm. In the past this has been about five acres, especially in Government established areas. Such an area does not usually permit sufficient room for the production of the necessary green feed when supplies are short. Neither does it allow for an efficient rotation system of the cropped land. Such small areas are usually in closely settled districts and no further land may be available for expansion.
2. Transport. If development of the industry is to occur further from the closely populated districts cheap transport for essential foodstuffs and farm produce must be provided.
3. Housing. There is ample scope for the general improvement in design and construction of housing and yard facilities.
4. New Breeds. Considerable advances are already possible in the development of breeds with greater disease resistance and superior qualities in the eggs produced but more research is required.
5. Testing individual birds. This practice should be extended as an aid to culling uneconomic producers.
6. Preparation of eggs for market. Great improvement is possible already, e.g. frequent collection, rapid cooling and cleanliness. More research is necessary, particularly to develop cleaning methods.

The main needs of the poultry industry, however, require further research for their solution. These may be grouped as follows :

1. Long-range genetical research. This is needed to develop such important characters as longer laying season, disease resistance and general hardiness, shell texture in the egg, keeping qualities, etc.
2. " Sexing " of chickens. More research is needed for the earlier detection of the sex.
3. Egg fertility.
4. Poultry nutrition and disease.
5. Storage, pulping and drying of eggs.
6. Mechanical aids in the preparation of by-products.

Soil Erosion.

Erosion prevention is largely a matter of using the land in agreement with Nature rather than in opposition. Two particular aspects of wise land use are as follows :

1. Greater care in the cultivation of erodable slopes. In the cultivation of erodable slopes, untold harm is caused by the continuous clean cultivation of such land. We need to pay greater attention to the following points : (*a*) practise more crop rotation, (*b*) keep the land covered with thick crop at certain seasons of the year, (*c*) investigate the possibilities of strip cropping, (*d*) Stabilize areas of steep, highly erosive land with grass, lucerne, trees, preferably of economic value, or other soil-holding crops. The emphasis should be upon vegetative methods of control. Mechanical measures such as contour banks should be considered a secondary defence.
2. Avoidance of over-stocking. Over-stocking is here considered with special reference to the Western Division. The basis principle upon which all remedies will hinge is that the vegetative cover must be restored and the stocking must be kept in equilibrium with this protective vegetative cover. The exclusion of stock, to give the natural plants a chance to grow, is remarkably effective, provided the damage has not gone too far. On the heavy clay soils when the whole of the surface soil has been removed by wind, it is extremely difficult, if not impossible, to regenerate the area without some cultivation, checkerboard ploughing, mulching, or other treatment.

There is still much to be investigated about the remedies to be applied to the Western Division.

There has been a good deal of destruction by erosion along both river banks and coastal foreshores. Valuable alluvial lands have been lost along some of the rivers, particularly on the coast. Protection will have to be provided at the points of greatest damage. Along the coast, the establishment of protective primary sand dunes by means of barricades and grasses, particularly marram grass, is needed to prevent the encroachment of sand hills.

Preventive and remedial actions required are as follows :

1. Confining of settlement to suitable lands.
2. Designing of land settlement so that good farming methods can be adopted.
3. Wise utilization of the land by the farmer, as outlined above.
4. Protection of river banks, foreshores and catchment areas.
5. Mechanical measures for ensuring the safe disposal of run-off water from public and private lands.

Fertilisers.

More efficient use of fertilisers could make a considerable contribution to the output and welfare of Australian agriculture. The outstanding fields for development in the use of fertilisers are considered to be the following :

1. The more extensive use of superphosphate, in conjunction with the establishment of subterranean clover, for pasture improvement. The possibilities for improvement in carrying capacity and nutritive value of pastures, and the beneficial effects of these on the livestock industries and agriculture generally, have been only touched as yet.
2. A national scheme for the improvement of acid soils with lime or dolomite, particularly the valuable coastal dairying lands.
3. The improvement of fodder crops and pastures on dairy farms by a more widespread and judicious use of fertilisers and particularly the more effective use of farmyard manure by distributing it over pastures.
4. Greater attention to time of application and placement of fertilisers to vegetable crops.
5. The more extensive use in orchards of phosphatic and nitrogenous fertiliser in the autumn for green manure crops either sown or natural, which are necessary for maintaining fertility in a perennial planting like fruit trees and should form part of the soil management technique. Mineral deficiencies such as magnesium, zinc and boron are apparent in various centres, sometimes on an extensive scale, indicating the need for applying the appropriate treatment on a sufficient scale.
6. There should be considerable scope at the present time pending the results of further work, to extend the use of known fertiliser practice among fruit growers.
7. Research into the best fertiliser practices to bring large areas of poor podsol soils in good rainfall areas into economic production.
8. Extension of research to determine the best use of N, P and K elements for the fruit and vegetable industries, and with minor elements to make it possible to bring into use poorer soils at present uneconomical for farming.
9. The adoption of a uniform numerical system of nomenclature for fertiliser mixtures, on the basis of the percentages of N, P and K present, instead of the generally uninformative and often fanciful nomenclature now in use.
10. It is recommended that the term " unit value " be changed to " unit cost ", to dissociate the two unrelated ideas of cost and fertilising value of a fertiliser.
11. The wider adoption of granulated fertiliser for specific purposes such as the use of granulated superphosphate on phosphate-fixing soils. Also the development of granulated mixed fertilisers, in which each granule had a fixed N, P, K or other ratio, to ensure even distribution.
12. The adoption and enforcement of definite standards of fineness of grinding in the case of some materials, for instance calcium carbonate, and of magnesium content in the case of dolomite.

Irrigation.

When considering irrigation in its relation to rural reconstruction two questions must be considered, namely (*a*) the development of new irrigation projects, and (*b*) maintaining and improving present projects.

(*a*) Development of new Irrigation Projects. Before any new irrigation project is begun the following two questions should be answered: (1) What crops can be grown on the proposed area? and (2) Is the produce from these crops required in the national economy or in world economy and, if so, can they be produced with a greater economy of labour and materials in other districts or without the provision of irrigation water? These are, of course, very big questions and are difficult to answer briefly.

A consideration of what crops can be grown will depend on a knowledge of the soil and climate, which is an agricultural problem, and on the availability and cost of water and its distribution, which is an engineering problem.

If, after a preliminary reconnaissance survey and investigation, it is decided to develop an area for irrigation, a detailed soil survey should be made. The soil survey should be accompanied by a geological survey to determine whether application of water in one area is likely to cause a general rise in the water-table of another area. Other studies may also have to be carried out to obtain information necessary to assess the suitability of the area for certain specific crops. For example, " frost pockets " may have to be mapped.

It is important that these investigations should be carried out by, or in association with, specialists on the subject, and that the various specialists should collaborate with each other. For example, the soil surveyor must consult with the irrigationist, and production and canning experts with soils and engineering specialists. It should be hardly necessary to stress this point of view, but unfortunately it is necessary.

(*b*) Maintaining and Improving Present Projects. The problem of irrigation is to apply water to maintain the soil at suitable moisture contents for the particular crop grown. This may necessitate considerations of the amounts that will give the best economic returns for a particular crop. For example, with pastures and fodder crops the most economic amounts of water to apply will generally not be the amounts that produce the highest yields per acre. With fruit and vegetables the amounts that produce the highest yields will generally be the most economic amounts. Such questions must be resolved for different crops.

However, the most difficult irrigation problem is to apply water with a reasonable economy of labour and material without causing waterlogging and salting of the land. This is especially important in fruit and vegetable production.

Correct irrigation depends on proper attention to (*a*) layout and preparation of land, (*b*) control of flows per furrow, check or area of land, and (*c*) frequency of watering.

Suitable frequency of watering is important with both spray and surface-flow methods, but particular attention to land preparation and flow control is required for surface-flow methods. The application of water by surface-flow methods depends on several variables such as (*a*) soil type (especially its soakage characteristics), (*b*) irrigation system (e.g. furrow, border or contour check), (*c*) layout (location of farm supply and drainage ditches, length and slope of watering run), (*d*) flow rate per furrow, border or contour check. The duration of irrigation on any particular area of land should be closely related to the infiltration rate of the soil. The flow rate is the chief factor concerned.

The interrelation of these variables is fairly complex, but certain principles are outstanding, namely, (1) for any given layout, control of the flow rate is the most important factor in irrigation management, (2) given suitable control of the flow rate, flatter slopes give the most satisfactory conditions for irrigation. Limitations to this are set by the shape and size of the furrow and by surface drainage requirements.

The length of watering run is important in irrigation control, but irrigation literature generally places too much emphasis on it and too little on attention to the flow rate.

In applying the required amount of water in a given time, flow rate control implies an even supply to the farm, good farm ditches, adequate outlets from them, attention to smoothing and preparation of furrows or banks for guiding water over the land without undesirable flooding, and adequate surface drainage to take the inevitable run-off from irrigation or heavy rains.

If these principles are applied it is possible to water almost any type of soil adequately without building up a high water-table or causing salt. On most soils, but particularly lighter soils, this requires almost constant personal attention during irrigation. Existing farm practice usually falls short of these requirements. The following list gives some examples of the causes for this, not all being within the control of the farmer :

1. Lack of sufficient properly trained irrigation specialists in research and extension work.
2. A general lack of appreciation of important irrigation principles. It is not implied that this is necessarily the fault of individuals. It reflects a stage in irrigation development associated with rapid recent progress in irrigation research.
3. Fluctuations in farm water supply—this is sometimes caused through insufficient cooperation between farmers, and with channel attendants.
4. Difficulty of watering during the night—where possible water should be deflected at night to soils and crops requiring less attention.
5. Insufficient finance to carry out essential jobs. A major difficulty has been provided by periods of low prices for particular crops. This often forces the farmer to neglect essential irrigation requirements. Under irrigation this can result in more or less permanent damage to the soil.
6. Insufficient labour supply—especially the skilled labour required for proper irrigation.
7. Lack of machinery or contract facilities for occasional but essential jobs requiring large scale machinery for most economical operation, e.g. earth ditch renovation.

The remedies for these difficulties are stated or are implied. The main remedy is to provide adequate research and extension services, closely associated with the administration and planning of irrigation areas. Viewing Australian irrigation areas as a whole the lack of sufficient personnel for these services is the most outstanding deficiency. The training of irrigation specialists is a lengthy process and is the most urgent present need in an attack on our more fundamental irrigation difficulties.

Some Aspects of the Horticultural Development of Queensland*

By
W. A. T. Summerville, M.Sc.

There has possibly never been a time when it was more important to make an attempt at an evaluation of the factors involved in the future of our primary products. Undoubtedly it is foolish to plan the horticulture of one region independently of the rest of the continent, but in some of the most important crops Queensland enjoys a virtual monopoly and thus plans for this State would automatically fit in with a more comprehensive one for the Commonwealth in general; whilst this address then deals with possible developments in Queensland, it is necessary to bear in mind throughout that affairs in this State cannot be divorced from the rest of the Commonwealth.

General Considerations.

Climate, of course, asserts itself as the limiting factor in the determination of what shall be grown. Queensland has a north-south length of more than 1,200 miles and there is naturally a gradation in climate; but the tropical influence extends considerably further south than latitude alone would indicate, and ecological study of the flora shows that tropical species flourish as far south as Maryborough, and that conditions are commonly quite satisfactory for their growth and multiplication down into New South Wales as far as about Lismore. This favourable range of warm to tropical conditions has two important effects on the fruit industry in this State. Firstly, Queensland can concentrate on species which cannot be grown economically in other parts, with the possible exception of a limited area of northern New South Wales, and, secondly, Queensland can produce some species at periods of the year when their production is impossible or comparatively costly in more southerly States.

In considering other than tropical or subtropical crops, local factors will play the dominant part. Stanthorpe, for instance, at an elevation of 3,000 feet, situated within 200 miles of Brisbane, has developed as a temperate-fruit producing district, a perfectly logical and sound development provided it is kept within certain limits. Likewise, the area is valuable for the production of summer vegetables. In the same way, other districts with a combination of some particular feature and nearness to market may be developed along specialized lines. All such development, however, would necessarily be rather limited in scope and would probably not be important factors in the general plans for horticultural expansion.

Fruit Crops of Particular Interest.

In considering fruits which will be of particular interest, my main purpose is to indicate what crops should be encouraged and the type of horticultural research work which will be of special importance if that encouragement is to achieve its objective.

Banana.

The banana should occupy a very prominent place in fruit production in this State and every effort should be made to ensure the maximum production consistent with economic considerations. The industry has declined very seriously in Queensland during the past decade and the first obvious step is to examine thoroughly the

* Presidential address to the Queensland Branch of A.I.A.S., 31st March, 1944.

causes of this decline. In 1930 the gross value of bananas produced in Queensland was £903,000 and nine years later the total had dropped to £373,750. The commencement of the decline appears to have synchronized with the heavy incidence of bunchy top, but the combination appears to be somewhat fortuitous, as the New South Wales industry, under similar conditions, has gone ahead rapidly. The policy of exploitation and the outlook of so many banana growers, who regard the cultivation of the crop as something of a nomadic occupation, may have been an important factor, but we must look for the basic cause somewhere behind all this.

The Cavendish variety is deservedly the most popular choice amongst growers and, although like other Musa species it does not mutate as readily as citrus or pineapple for instance, there is reason to believe that within the species *M. cavendishii* there are strains of particular merit. The plant breeder should certainly be called upon to examine this whole position.

One of the most important features in banana production is the length of economic life of the plantations. This is bound up with nutritional factors and I think we are now in a sound position to go ahead on studies of this aspect. These studies are of outstanding importance and should be pursued at the earliest possible moment. Whatever the result of the strain examination, it is certain that a really stable industry cannot be expected till we know more of the nutritional requirements of the plant. That we have been able to carry on so far without this basic knowledge must be due largely to the opening up of the new areas as old soil becomes depleted ; but the ever-decreasing area of new land available is forcing us to seek ways of managing the soil. Nutritional and plant breeding studies must then form part of any plan to increase banana production.

Pineapple.

In their enjoyment of a virtual monopoly, pineapples are perhaps the most fortunately placed of the major Queensland fruit crops. A somewhat limited increase may be possible outside the State, but on our present knowledge pineapple production in these potential areas would be risky and disaster might easily ensue—one has only to consider the frost damage in the Maroochy district, sixty miles north of Brisbane, during 1943 to realize what could have happened in areas south of Queensland.

The general requirements for the successful production of this crop are known and we are in a position to give sound advice as to the suitability of any particular location and soil. The outstanding problems are concerned mainly with reducing costs of production, which are of particular importance in that so large a proportion of the crop is sold as a canned product, and thus often in competition with other fruits.

Whilst the present general standard of type and quality of fruit is high, the pineapple mutates very readily and so it is obvious that to maintain quality and production, let alone improve them, we require a very close watch on planting material, and in order to develop the crop to the extent desired we shall need further investigation on genetical lines.

Citrus.

Queensland has very large areas of soil which, for citrus production, would be hard to surpass anywhere in the world. The water supply is adequate, or could be made so very readily, and the climate is suitable, so if agricultural factors alone had to be considered expansion could be on a tremendous scale. Costs of production are reasonably low and besides, I have yet to see better quality citrus than that produced locally, although I have visited many of the principal citrus-producing countries of the world and examined fruit from virtually all the remainder. Fruit fly infestation is likely to continue seriously to limit export of many varieties of

citrus from this State, and so distance from large local domestic markets will constitute an obstacle to development. Widespread expansion here, however, would have its repercussions in other areas in the Commonwealth—at first, Queensland would be enjoying the major share of the available markets, but very shortly the undercut producer in other States would be selling his land and equipment at a figure sufficiently low to allow the newcomer to produce satisfactory returns and eventually the outcome would depend on marketing costs, with Queensland having much the higher transport charges.

Despite these factors, there is room for some expansion of citrus production in this State. The earliness of our season should allow a limited increase in the production of early varieties such as navels and grape-fruit, but an unlimited expansion is not warranted and a close watch would have to be kept on plantings. The fruit fly is a factor to be considered but most important is our ignorance of reasons for the erratic behaviour of the navel orange, and the wide diversity of strains within the variety ; both problems will have to be investigated before embarking on any policy of expanded navel orange production. In grape-fruit, root-stock problems need attention before much else can be done.

The greatest room for expansion is in the lemon industry in areas removed from the coast. In these districts the product is of a particularly high standard, and in Australia the lemon is still largely in the luxury class of fruit. This should not be so and the existing markets could certainly absorb much heavier supplies. Much progress has been made in certain phases of lemon production, but there are still many gaps in our knowledge, and in particular the pre-blossoming treatment of trees to ensure that crops will mature at favourable times needs increased attention. There are also many problems of irrigation awaiting solution.

There is a great need for nutritional studies on all the citrus fruits but before the data could be interpreted a great deal of fundamental physiological work will have to be done.

Papaw.

The future of the papaw depends principally on three factors : (*a*) the extent to which canning is developed, (*b*) the facilities for transport, and (*c*) the quality of the fruit. Of these three the last is of particular importance, for the extent to which canning is developed is certain to be influenced by the type of raw fruit which the canners receive. The behaviour of the fruit during transport will also be influenced by the same factor. Directly, of course, quality will enter into the question of public demand, and, perhaps even more important still, is the fact that fruit rots constitute a most serious trouble with many of our present strains.

Considerable progress has been made in the work of breeding suitable strains ; it might be well to mention that, as with several other foods, the requirements of the fresh fruit market and the canning factory are not identical. This aspect is of such importance that if increased production is contemplated, and I believe it most certainly should be, breeding work will have to be continued and expanded. Necessary supplementary work will include the study of nutrition, storage and transport problems. It does not seem that sudden expansion of the industry is likely, nor should this be encouraged, but a gradual increase should be our aim for a few years at least.

Passion Fruit.

The passion fruit is mainly a supplementary fruit, since its greatest virtue is its characteristic of imparting flavour or improving that of other fruits, particularly other tropical species. Its future development therefore is bound up with that of other Queensland fruits, and in this direction the canning of papaw will probably be of some considerable importance.

It is doubtful whether passion fruit production could ever become a really large industry but its importance may easily be out of all proportion to its magnitude. Both for its primary yield and its auxiliary rôle, the growing of passion fruit should be encouraged to the limits set by economic considerations. The use of passion fruit as a cash crop in a young orchard is one which should be encouraged. The limits of production are more likely to be determined by pathogens than by the lack of horticultural information, and, whilst our knowledge of cultural requirements is very empirical, it seems that the limited expansion visualized would not be affected greatly whether research is carried out or not.

Strawberry.

The strawberry is scarcely a sub-tropical fruit and it is in this fact that the key to our future work in Queensland lies. At the present time varieties and strains are rather jumbled, so much so that although planting material was carefully selected within the range which growers designate as variety it was still so heterogeneous that fertilizer trials were valueless and the nutritional studies had to be abandoned. Instead, some breeding work was initiated and a number of strains reputed to have outstanding merits, either as breeding material or as stable, proved varieties in sub-tropical climates, were imported. It is felt that there is much room for improvement over the varieties now growing here, or at least, that within those varieties there are strains which are inferior and which should be eliminated. During the war we are simply holding the imported material, but plant breeding work should be a major project for strawberries, when normality is restored.

Certain districts in south-eastern Queensland can produce strawberries of outstanding flavour and there is room for expansion for both the Brisbane and southern markets.

Avocado.

From the dietetic point of view alone the production of the avocado should be encouraged. That aspect of course is not likely to carry much weight with the orchardists, and it is fortunate that there are good reasons for believing that the fruit is likely to prove a very sound economic proposition. It seems safe to accept Californian experience as a guide and the growth of the industry in that part of the world has been phenomenal. In the 1934 season 130 tons of avocados were produced in U.S.A. In 1936 the total had risen to 6,700 tons and in 1941 it reached 17,250 tons. Prices of course have declined, but they are still such that plantings are increasing. I think these figures should indicate our course and we should try to develop the avocado industry.

In many respects we are fortunately placed for this work. From the birth of the industry sound research has been carried out in U.S.A. and thus we can avoid many of the errors which citrus growers, for example, inevitably committed. We have much data on soil and climatic requirements of the avocado and what is most important, a good deal of information on varietal characteristics. This information is, of course, largely drawn from American data and has still to be translated into precise local experience, but at least we can reduce very considerably the amount of work necessary by eliminating many of the blind alleys, which, in other circumstances, would have to be surveyed. Some work has already been commenced and small observational plots are being maintained in near-north coastal areas. From these we have already learnt a good deal and with a little further research work we shall be favourably placed to help in the well worth-while expansion of avocado growing. Plant breeding knowledge will probably be of greatest value in the first phase.

Mango.

The future of the mango, as I see it, is paralleled by that of the papaw, though to some extent from the point of view of research we are more favourably placed with

the mango, in that we have some excellent varieties which can be propagated asexually. We thus have the raw material for expansion at hand. There are, however, still many fundamental questions to be answered, particularly concerning stock-scion relationships. The climatic requirements of the mango also need further study in relation to potential areas of production. Whilst the fresh fruit markef no doubt could absorb, at reasonable prices, a very considerably increased amount of this fruit, it would be very easy to exaggerate potentialities whilst the transport facilities remain as they are at present, or were before the war. Processing would provide an outlet for an appreciable increase in mango production and there does seem possibilities in this direction. However, it is difficult to forecast the fate ot such operations since agricultural factors are not likely to be dominant, at least in the absence of a " new order ".

Deciduous Fruits.

The potentialities of the granite belt surrounding Stanthorpe have been exploited to some extent and the growing of stone fruits, apples and grapes support several thousand people. Stone fruits grown in the district have one big advantage in that they mature earlier in the season than comparable species in more southerly parts. Insofar as fruit fly permits, stone fruit production is thus a good proposition. The same may be said of early varieties of apples, such as the Gravenstein and, to a slightly lesser extent, the Jonathan. The Granny Smith apple also has its place, since it provides material for a comparatively small, but paying, export trade. Late maturing varieties do not enjoy the same immunity from competition and expansion does not appeal. The grape is the only one of these fruits which engenders any enthusiasm for expansion ; for the rest I would say keep the production within bounds of the existing local markets. The minimum conditions of climate are met for pomaceous and stone fruits, but the soil varies from marginal to sub-marginal over a great part of the district. We are very ignorant of the nutritional requirements of the deciduous fruits in the Stanthorpe district and it would be well worth while to expend some research energy in determining those requirements. There is undoubtedly a basic problem on root stocks, and soil management problems abound. These latter in particular merit investigation, not only for the sake of Stanthorpe growers, but because the data collected almost certainly will help in the solution of soil problems elsewhere. Research then should be planned entirely with a view to lessening costs of production and not with the idea of increasing the production to any marked extent. Lessening costs of production is perhaps the ultimate aim of almost all agricultural research, but in this case the idea I have is that we should endeavour to discover how existing orchards can be improved in relation to the economic life of the trees, rather than that we should embark on long-range work aimed at improvement of varieties or bringing larger areas into production.

Grapes.

I have already proclaimed faith in the grape industry in the granite belt and I think that I might extend those remarks to other inland districts. There are many indications that in several areas of Queensland very fine quality table grapes can be produced and it seems that we could with advantage grow more of this good quality fruit. In some respects the export of Stanthorpe grapes is without parallel as far as I know, for here we export overseas grapes grown in a summer rainfall belt. It is only a very small export trade, but it is capable of expansion, particularly if the promised extension of air transport eventuates. At the moment its chief importance is that it indicates that the quality of the grapes is high. If the grape industry is to be expanded, there will be need for investigation on several lines—root-stocks, stock-scion relationships and nutrition. Whilst no tremendous expansion is visualized, some increase is warranted, and the investigational work mentioned is certainly justified.

Fruit Crops of Lesser Importance.

Under the heading of fruits of lesser importance are species such as dates, custard apples, nuts and melons. With the possible exception of nuts these would scarcely demand much consideration at this stage. Dates certainly have some possibilities, but U.S.A. experience shows that it is useless to toy with the introduction of this crop ; it should be done well or left alone. The rate of growth and reproduction is so slow that only fairly large-scale work is likely to give results of any value. If finance and men were available I think something should be done, otherwise it would be better to get our dates from the grocer. Custard apples probably always will play a minor rôle, though they may be important in individual cases. Their production is not likely to assume any degree of importance in the economy of the State. Water melons almost certainly will continue along in the way they now go but rock melons, judging by U.S.A. experience, may be developed considerably with comparative ease. In this connexion the plant breeder will probably be the most important person.

Queensland nuts, to give them a better title than the normal Macadamia, are something of a problem. That it is a very fine nut is unquestionable, whether we judge on palatability or chemical analysis, but the industrial future is doubtful. It is not likely to assume an important position till efficient methods of asexual propagation have been evolved, and that awaits a thorough investigation of the anatomy and physiology of the plant. The potential value of the nut justifies the resumption of work on this species at an early date. In the meantime it would be unwise to encourage large-scale plantings.

I have no enthusiasm for the pecan. It is a good nut, but not superior to several others, and studies in U.S.A. lead me to conclude that returns to growers would never justify its production on the class of land it would require.

Other species of nut might be grown in some of the high elevations of the Darling Downs but there is no promise of a worthwhile industry being built in the near future.

Vegetable Crops.

Queensland has immense possibilities for the production of vegetables. In the Brisbane district, the Lockyer, and the south Burnett, the central Burnett and several districts in the north there are thousands of acres of land which could be devoted successfully to the production of these crops. However, the agricultural potential is never likely to be the determining factor. Markets and transport will certainly set the limits and, for a considerable time at least, those limits will be well below the possible maximum. Markets are not a simple factor in this case for there are two aspects—that dealing with fresh vegetables and that with the canned product. The latter is the more difficult to assess since at the moment the position which the processed article will occupy in the future is by no means clear.

The indications at present are that processing will be developed considerably in the southern States. If this be so, Queensland will suffer competition during seasons when the fresh market is now largely open for our products. Thus to an extent the advantage which we have from warm winters will be offset. I think, however, most people will prefer the fresh article to the processed, providing qualities are comparable, so that the first part of Queensland's answer will need to be production of high quality vegetables. Whilst raw materials are usually bought at a low price, processing must add to the cost, and therefore the second part of our answer will lie in reduced costs of production. Whatever the development of canning in the southern States, we must intensify our efforts to improve quality and reduce production costs. For this we will have to investigate problems of plant breeding, nutrition, and soil management, including irrigation practices. At the moment, we are engaged in preliminary work on each of these phases, but of course, we are

concerned largely with day-to-day problems. However, as we go along we are learning the nature of the basic problems, and I believe that shortly we shall be able to define specifically the problems for each phase ; with the return to normal times we should then be in a position to go ahead with a reasonable perspective of the whole.

The extent to which canning of vegetables in this State will develop is very problematical. At the moment there is an attempt being made to foster the industry, mainly as a means of handling surpluses of the fresh market, and there is much justification for the action. Although it appears to be the opinion of some that a canning industry can be built on these lines, I cannot subscribe to that view. I have seen a good deal of such industries in other parts of the world, and everywhere the production of the raw materials is as much a part of the industry as the processing. As a basis for cannery treatment the intensive market garden must be supplanted by extensive truck-crop farming. Canneries can function efficiently and economically only when known quantities of a certain quality article are available at a previously known time. The fresh market requires supplies of comparatively moderate amounts over an extended period. The cannery demands heavy supplies over short periods from any one area, and qualities desirable for consumption as fresh foods may make them quite unsuitable for processing. Production for canning and production for fresh markets are then almost quite different industries, even though the same species of plants are involved.

There is no doubt that a sound canning industry could be built up in Queensland, insofar as natural facilities are concerned, but such a development would depend for its success on other factors. Government policy would be of importance since an export trade would be highly desirable, if not an absolute necessity, and the degree of success would be bound up with the degree of organization of the farmers ; the goodwill of those now largely engaged in canning would be of moment.

Leaving aside for the moment the question of transport, there will probably be no need for Government encouragement of the market garden industry—the normal laws of supply and demand will take care of expansion, and as the crops are all short-term ones there will rarely be much lag between the two. This does not mean that no assistance can be given to the market gardener or the small truck farmer, such as the bean grower. One outstanding lack at the moment is the absence of any up-to-the minute information concerning the degree of saturation of the market of the immediate future. I doubt that any agricultural research could yield as valuable information for the vegetable grower as an accurate statistical service capable of conversion to crop forecasting. The more successful agricultural research is, the easier it will be to produce, and therefore the greater the necessity for some such an information service.

In the agricultural field there are many problems which will need attention—the provision of high-standard seeds, the production of more suitable varieties than are at present available, problems of nutrition, irrigation practice and soil management. Work should be done on each of these so that costs of production may be decreased and quality of crops improved.

Transport and Market Problems.

As was pointed out previously, market and marketing must be given very careful consideration when planning horticultural development. The horticultural scientist and the farmer can do little about creating markets but, by studying requirements and producing the desired article, they can contribute in a large degree to their exploitation. This side of horticulture has been given comparatively little attention in this State and it must be recognized that the days of haphazard methods are nearly over. Varieties which sold well formerly are nowadays quite often not a business proposition. The mere fact that the variety is really a good one is of no

importance—it must be a popular one. The variety Fewtrell Early is a very poor quality mandarin, but for some strange reason it always brought very good prices on the Melbourne markets, though Brisbane people almost refuse to buy it. A large percentage of growers on the Blackall Range, recognizing what a poor mandarin it really was, destroyed their trees—the remainder, not so moral perhaps, then made even bigger money out of it. Most Californians confess that one variety of celery, which is grown on an immense scale in that State, is to their taste very poor, but the New Yorkers buy it, so Californians oblige with supplies. Fancies of different markets can be arrived at slowly and painfully by experience, but that is a poor method and should be discarded. A specialized study would give the same results more accurately and with much less trouble. The results of this study can then be passed on to the farmer, nurseryman or plant breeder, as may be appropriate. There is a very definite need for this development, which will be in the interests of both producer and consumer.

About the only virtue of the present transport facilities is that survival of the fittest pertains and only sound produce has a chance of reaching a destination more than about 100 miles from the farm. Unfortunately a large percentage of growers will never learn this, and consequently whole consignments, or even train loads, drop considerably in value because a proportion arrives in poor condition. The grower is the chief financial loser but the consumer must also suffer, and it is therefore a matter of State interest to have adequate transport facilities. These will have to be improved at the earliest opportunity and should not stop at the provision of a few refrigerated waggons, though these, and the provision for servicing them, would be a first step. Transport in refrigerated cars begets problems in pretreatment and packing, which will have to be investigated. Methods of handling at destinations and the routing and distribution necessarily would need to be reviewed. Some of these questions could no doubt be answered quite well by intelligent interpretation of practical experience but others will call for specialized study and experimentation.

Conclusions.

The production of fruit and vegetables in Queensland is capable of being increased very considerably, and even when the limits which may be imposed by non-agricultural factors are given due consideration, it is believed that efforts should be made to expand the production of a considerable number of our principal orchard products.

The returns per acre from orchards are amongst the highest. Sugar cane and tobacco are the only two crops grown to any extent in this State which can compare with fruit in this respect. For all principal crops the average gross return per acre is about £11, for sugar £40, for tobacco £52, and for fruit £55. Of course the acreage which one man can work is smaller in fruit than in most crops, and the capital cost of the land and equipment is higher, but without claiming to know much about general field crops, I feel confident that we have a higher percentage of drones in the fruit industry than in most others and if the average return now is £55 per acre it is possible to make very good money from fruit and vegetable production in Queensland. A relative drop in returns may be expected if production is considerably increased, but all the evidence suggests that the industry is in a sound enough position to be able to withstand such a drop in prices. The fruit growers' problem is a dual one—firstly, production, and secondly, distribution. Providing appropriate steps are taken to raise the efficiency standards in each of these phases, I believe the industry can be very considerably increased to the benefit of both the individual and the State. I have endeavoured to point out, in a very general way, the type of work which will be necessary in connection with marketing, and in a little more detail, but still in general terms, the scope and type of agricultural research work which it appears will have to precede, or at least accompany, the justifiable expansion of

each branch of the industry. Finally, I would point out that unless an adequate extension service, closely coordinated with all the theory and the research work, is provided, little progress can be expected.

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Rural Reconstruction Commission

A SUMMARY OF THE FIRST REPORT

The First Report of the Commission is intended as a preliminary survey of the field. The Commission intends to report at length on most of the matters mentioned in the First Report at a later date.

Chapter 1.—General Review of the Australian Rural Economy.

Introduction. The following general points emerge from the first part of this chapter :

(*a*) Success or failure in rural production is a resultant of many complex factors. The suitability of soils and climate is a primary consideration, but the technical knowledge and industry of the farmers is also of the greatest importance. To these we must add the economic influences of markets and prices, transport costs, forms of land tenure, and size of farms. Finally, such sociological factors as the amenities of living, the hours of work, the opportunities for recreation and social intercourse, and the educational opportunities, have a marked significance for each rural economy.

(*b*) There is a gap between modern knowledge and field practice, which is partly a matter for increased education, but which also often reflects an insufficiently developed community spirit.

(*c*) We must be prepared to learn from the wide range of agricultural organization and development in other countries.

(*d*) Improvements in our land utilization presuppose effective statutory powers to ensure cooperation of everyone in a general scheme for the maintenance of soil fertility.

(*f*) The rural economy is a basic part of the national structure whose functions are to provide the raw materials for many vital human requirements. The emphasis at the Hot Springs Conference on raising the level of nutrition and improving the efficiency of agricultural production gives new point to this view.

Need for Rural Economic Surveys.—Australia has been backward in the study of all branches of rural economics and the Commission emphasizes the need for exhaustive analysis of the problems of the countryside. An organization for making a continuous survey of rural problems would entail a large annual expenditure, but it should be able to save much larger amounts.

Problems of Co-ordination.—The Commission draws attention to the special problem created by the Australian Constitution in devising plans for efficient development. It is considered that the main directions in which united Commonwealth-State action is needed are finance, overseas trade, agricultural policy, and land settlement.

Agricultural Policy.—The Australian Agricultural Council has not produced an all-Australian agricultural policy, such as will be vital to sound development.

Chapter 2. The Place of Rural Industries in the Economic Life of Australia.

Rural production provides the raw materials of all food, most of the clothing, and a large part of the housing of the people. It also pays for import requirements and meets the interest on the overseas debt. It is estimated that 26 per cent. of all breadwinners are directly dependent upon primary production, including transport and direct processing, for employment. The value of production constitutes from one-fifth to one-fourth of the national income. In the ten years ended 1939-40 rural industries provided 82 per cent. of Australian exports.

The general level of business activity and consumers' purchasing power affects the prosperity of all rural industries. Conversely, the fall in the incomes of primary producers is reflected in slack conditions in other industries.

In the long run, our prosperity depends on overseas funds obtained from the sale of a comparatively few products, and changes in the value of these products have wide economic results for the whole community.

Improved wages or conditions for workers in secondary industries place farming industries in a worse condition unless there is a proportionate increase in efficiency, or farming industries are artificially aided, or the improvements are accompanied by a general rise in price levels.

Chapter 3. The Lessons of the Agricultural History of Australia.

The Commission distinguishes five periods in the agricultural history of Australia.

(1) 1788-1820—*From the first occupation to the expansion of the wool industry.*—The first period contains important lessons for the present in that it shows the difficulty of introducing new crops without the development of proper techniques, the need for considerable capital for agricultural development and the serious problem of price fluctuations for commodities which have no export market.

(2) 1820-1852—*The phase of wool alone up to gold discoveries.*—In the second quarter of the century, the wool industry progressed rapidly because its product was in urgent demand, and the technical adjustments needed were relatively simple. However, a serious collapse of prices in the 1840's early demonstrated that the production-cost structure of an industry can be maintained only as long as the demand for the product continues on a scale which is in line with the volume of production.

(3) 1852-1880—*The gold rush period.*—The gold discoveries created a great disturbance in the economy of the pastoral industry, but the increase in population from 405,000 in 1850 to 2,232,000 in 1880 meant a big increase in the demand for all forms of agricultural products.

The opening up of inland centres and the high cost of cartage, emphasized the need for railway construction. Railways made possible agricultural development along the lines for which each region was most suited.

People began to experiment and devise ways of overcoming the various problems of the primary industries. Irrigation was discussed. Refrigeration was a subject of continuous experiment, and new devices for farm machinery were tested and gradually came into use.

Great technical advances were occurring in British agriculture, and these stimulated interest in the breeding of new varieties and other lines of development.

Increased population brought about changes in the national attitude towards land development and ownership. The focal point of discussion was the use of the land for the welfare of a larger number of people. The success of this subdivision was varied, but one thing is obvious, that subdivision has little merit unless it has a sound agricultural and economic basis.

(4) 1880-1930—*A stage of general agricultural expansion.*—Despite setbacks, the period from 1880-1930 was the great period of agricultural expansion in Australia.

The dislocation of European production by the first world war led to a great increase in world prices of many agricultural industries, and created a general atmosphere of optimism in Australian agricultural development. The attitude towards farming which is developing in 1943 is so close to the attitude of 1919-20 that it deserves careful review and intense analysis. It will be a major blunder if schemes of agricultural expansion are launched without a realistic review of market prospects.

(5) 1930 *to the present time.—A period of economic and social upheaval.*—Alleviation of the effects of the collapse of prices in 1930 was sought in imperial preference, the increase in the exchange rate, the extension of the home consumption price principle, and in moratoria and reduction of interest rates.

The depression brought about, to some extent, a psychological change towards farming. For the first time, attention was directed towards the limitation of our resources and the undesirability of production without markets.

The second world war has added even further problems to the lives of tired farmers already worried by ten years of difficulty.

Chapter 4. General Economic Factors which will Influence Land Utilization in the Post-war Period.

Agricultural expansion turns upon the finding of markets. In the event of efforts to increase world trade proving abortive, the only expansion of agricultural production justifiable would be that required to bring the diet of the Australian people to a satisfactory level, and provide for any increase in Australia's population.

The chief items, which would be consumed in larger quantities, would be milk, vegetables, fruit and eggs.

It is stressed that international acceptance of the spirit of the Atlantic Charter and the terms of the Resolutions of the Hot Springs Conference would mean wider markets for Australia only if costs are kept down.

During the war, price levels have been distorted in all sorts of ways. Sooner or later the prices of the goods farmers buy and the products they sell will find their new levels, and the success or failure for many farmers will depend on the relative position of these levels.

The importance of maintaining fairly stable price relationships for at least the major commodities used and produced on the farms cannot be over-estimated.

In connection with stabilization of prices or minimum prices, it must be remembered that any schemes inevitably involve a rationing of production.

Chapter 5. Factors Influencing Costs of Production.

The Commission emphasizes that lowness of cost will be of basic importance in determining success or failure in any new land settlement.

Attention is drawn particularly to the need for soil surveys as a preliminary to land settlement and the need to think in terms of the seasonal incidence and variability of rainfall and the risk of hail or frost.

No agricultural development should be planned which does not guard fully against the danger of erosion.

Present technical surveys should be improved if Australia is to expand or even maintain her agricultural production.

In the long run, water supply will be a limiting factor in Australian agriculture, and every scheme for the diversion of water needs to be carefully scrutinized. More irrigation experimental farms are an urgent necessity.

The size of farms is of major significance in determining the standards of living. The Commission is emphatic on the inadvisability of the one-man farm as an economic

unit for most kinds of agricultural production. It should be the long-range objective to induce a gradual increase in size until all farms are large enough to warrant the mechanization which is necessary to make possible low cost production.

The question of land tenures and land values is held over for discussion in a later report.

While the liquidation of unmanageable debts is important, it is equally important that existing schemes for rural credit be carefully scrutinized to prevent repetition of the mistakes of the past.

Urgent consideration should be given to the completion of a general scheme for fixing equitable wages for all farms and industries.

The transport system should be organized on a basis of efficiency so as to minimize costs.

Chapter 6. Forestry.

The timber situation in several States is now serious, and a large expansion of forestry is essential.

Chapter 7. Social Conditions of Rural Life.

The Commission believes that the provision of electricity would do more to bridge the gap between city and country than any other single factor. It should be a national objective to give every farm, which is not too remote, an opportunity to use electricity at a cost comparable with that which prevails in the cities.

The Commission considers that the minimum equipment for housing should include, in addition to ventilated rooms of reasonable size, a reliable water supply, a kitchen sink with water laid on, adequate cooking facilities, bathroom and a wash-house, and satisfactory arrangements for food storage. So important is the preservation of foodstuffs during the hot weather that it is suggested that consideration should be given to the mass production of such equipment by the Commonwealth and its availability to the public at a satisfactory price.

The establishment of a satisfactory supply of farm labour will depend to a great extent on the improvement of housing conditions for farm labourers.

The fixation of minimum wages is an essential step in the agricultural development of Australia, but flexible and impartial administration will be essential to ensure the best results both for farmers and labourers.

The Commission has been impressed by the widespread dissatisfaction with the present system of education. Opportunities for education at the higher levels are inadequate. The nature of the education given has insufficient relation to the realities of farm life, and the importance of technical knowledge in present day farming is inadequately catered for. The problem of adult education also needs careful consideration.

The expansion and careful planning of extension services should be a definite part of post-war policy.

There is much to be said for the foundation of community centres, comprising an adequate library, meeting rooms, and possibly a baby health centre.

Medical services are not considered in detail, as this matter has been dealt with by the Commonwealth Joint Committee on Social Security.

These special problems of the countryside must be considered in relation to administration. In many quarters the view has been expressed that the time is now ripe for a measure of decentralization of the various services. The Commission proposes to report on this subject at a later date.

All proposals for the decentralization of industrial life will have to be approached with some degree of caution. Adequate water supply, reasonably cheap power, an

efficient transport service, and sufficient development of social amenities are prerequisites for the decentralization of industry.

Chapter 8. Economies between Producers and Consumer.

If farm efficiency is the corner-stone of agricultural development, the economical organization for collecting, processing and marketing the products is the keystone of the superstructure. The main points to be considered here are the prospect of marketing economies, industry organization, and the efficiency and location of processing plants.

Chapter 9. Sundry other Matters.

The highest priority should be given to the preparation of machinery necessary for securing superphosphate from Nauru as soon as this is militarily possible. While not generally in favour of subsidies, the Commission supports the continuance of substantial assistance to the users of rock phosphate.

The Commission recommends the continuance of price control for many commodities, such as structural materials, until such times as stocks have been built up.

Conclusion.

If our farming is to be reinvigorated by improved social services and by the provision of a wider and better scale of amenities on farms, considerable cost to the general taxpayer will accrue. In return, the Australian nation has every reason to expect that its foodstuffs will be provided efficiently and at as low a cost as is commensurate with a reasonable standard of living for producers.

W. H. Pawley.

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Research and the Future of Wool

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Considerable publicity has recently been given to the establishment of a comprehensive research organization in Australia as a means of fortifying the competitive strength of wool against the incursions into the field of textiles of synthetic fibres. The proposals appear to be based on a scheme promulgated by Clunies Ross and published in a recent issue[10] of this Journal. In the same number of the Journal, Penfold[9] reviews, somewhat enthusiastically, recent developments in the field of synthetic fibres and sees in them a serious threat to the survival of wool as a textile. Progress in the development and use of the various synthetic fibres has also been briefly reported by Wilson.[11] The issue raised is of such vital importance to the economy of Australia and to a less extent South Africa, New Zealand and the Argentine, that it merits the most realistic and highly informed discussion by all who can contribute to an objective appraisal of the situation. The problem of assessing the prospects of wool is particularly difficult in that it requires intimate and highly specialized knowledge of four wide fields—textile technology, industrial chemistry, agriculture and economics ; and it is very doubtful if there is one man

in Australia with sufficient knowledge in all these fields to enable him to make a true judgment of the problem. Uninformed or unbalanced discussion may do this country considerable harm either by stampeding it into the belief that its most important agricultural product is likely to be unsaleable in the near future, or by lulling it into a false sense of the indispensability of wool. It is well, therefore, that all statements on this subject should be critically examined and any contributions to the discussion welcomed.

Place of Synthetic Fibres and Wool.

There is no doubt that technical progress has been developing at an ever-increasing rate since the last war, and that great strides have been made in the field of synthetic fibres in recent years. The struggle for national self-sufficiency has been a powerful stimulus to these developments, but it need not be assumed that the materials that are welcomed under the pressure of national expediency will be equally acceptable if and when that pressure is withdrawn. However, it is certain that some of the fibres that have been recently developed will find a permanent place among the textile materials. The problem is to estimate the dimensions of that place.

The production of rayon and staple fibres from beech and spruce forests, even though these low-temperature forests regenerate rather slowly, and the production of " vinyon " and " nylon " from by-products of coal, are justifiable uses of resources, but one's intelligence does rebel against the use of casein for the production of " lanital " and " aralac ", and of edible proteins (e.g. soya bean) for the production of fabrics. As long as the total production of milk in most countries, including Great Britain, U.S.A., Italy and Australia, remains far below the amount required to give to every person the minimum amount of milk for optimum health, one feels that the sheep should be left to harvest and convert to wool the protein from areas that cannot readily make any other contribution to man's needs ; nor does one welcome the prospect of any edible proteins being used for textiles so long as there are people needing them directly or indirectly for food. It is satisfactory to know that these materials can be used for textiles should their supply exceed the amount required for more essential purposes. In a rational world, if that is not too much to hope for, we would not, like Cleopatra, dissolve our pearls in wine or jeopardise the health of our people to adorn ourselves.

Penfold[9] emphasizes the qualities of these synthetic textile fibres and the degree to which they are made to imitate the appearance and properties of wool. It might be well here to recall these particular attributes of wool, which have been ably reviewed by Freney[5] and publicized by the International Wool Secretariat. They may be summarized thus :

1. Wool fibres are of very high tensile strength, whether wet or dry, in comparison with their weight.
2. They will withstand an almost unlimited amount of bending without breakdown.
3. They are very elastic, not only due to their crimp but also to changes in their molecular structure, which is normally reversible, but can be made irreversible by " setting ".
4. They can be made to felt and supercontract.
5. They can be processed in a large variety of ways to give a large variety of fabrics notable for their warmth, strength, softness, lightness, durability, appearance or other qualities.
6. They are resistant to acid and have a strong affinity for dyes.
7. They are highly absorbent.
8. They burn reluctantly.

Their disadvantages are that :

1. They felt too readily under certain conditions. This disability can be largely overcome now by any one of several anti-shrink processes.
2. They are irritant to some skins. It is claimed this can now also be largely overcome by the " papain " treatment.
3. They are attacked by certain insects, e.g. the clothes moths and the carpet beetle.

It is doubtful whether the properties conferred on wool by (*a*) its biological and chemical constitution and (*b*) its bio-physico-chemical structure are as widely appreciated as their importance deserves. The crystallographic work of Astbury[1, 2] has shown that keratin consists of chains of molecules systematically arranged parallel to the fibre axis, that these molecular chains themselves stretch under tension, and that, although they will normally return to their original condition, they can be " set " or reorientated in this stretched position. One feels that many of the unique properties of wool, its strength, elasticity and resistance to wear or bending, are associated with this definite bio-physico-chemical structure, and that no synthetic fibre without a similar systematic molecular and particular arrangement can reproduce these qualities.

In fact, no synthetic fibre yet produced does reproduce this structure. Rayon and staple fibre do reproduce reasonably well the molecular structure of the natural cellulose fibres, such as cotton and flax, the crystal structure of nylon and vinyon is not very dissimilar to that of natural silk, but that of " lanital " and artificial fibrous proteins (such as that made from soya beans) are irregularly arranged and unorientated unless stretched. When stretched they resemble the structure of silk rather than wool, and can be classed more as substitutes for that material than for wool.

This discussion of the fundamental structure and qualities of various fibres constitutes the background against which their relative merits must be reviewed. Even though their intrinsic merits may not be the prime determinants of the extent to which the various textile fibres will be used by the manufacturer and preferred by the consumer, they are important ones.

Cost of Synthetic Fibres and Wool.

Much has been made of the relative cost of the various raw synthetic fibres as compared with raw wool, but this is of importance only to the extent to which these fibres can act as substitutes for wool. In the ten years before the war the world production of rayon and staple fibre quadrupled to equal or slightly exceed in weight the world production of wool.[4, 8] During the same period the world production of cotton, which normally is about six times the weight of wool, also increased. The fact is, that in spite of the increase in the total production of raw textile fibres due to the development of synthetic fibres, all of this material has gone into consumption in one way or another. In the last ten years the world's population has increased (even if it be at a declining rate), but the production of wool has remained practically stationary. It may well be that the development of synthetic fibres will, at least for a time, discourage any increase in the world supplies of wool, by providing an alternative fibre which can be used to dilute the supplies of wool and so check any tendency for its price to rise.

The most convincing of Penfold's prognoses is that, into the field of textiles now strongly held by wool, there will be a partial intrusion of synthetic fibres which will be used in mixtures with wool to produce (*a*) new effects and properties and (*b*) cheaper fabrics. Both of these results could conceivably still further *increase* the demand for wool if they increased sufficiently the turnover of the mixed fabrics.

The extent to which cheaper raw materials can result in a substantial lowering of the price to the consumer of the finished fabric is uncertain. Past experience has shown that when the price of raw wool was at a very low level during the depression years, the prices of many finished fabrics were not greatly changed. The costs superimposed on material from the time it leaves the factory to the time it is purchased by the consumer are so great as to render insignificant in the final price any small economies effected by the producer or even by the manufacturer. In evidence to the Commonwealth Rural Reconstruction Commission, the President of the Australian Wool Producers' Federation (F. E. Hitchens[6]) quotes the following figures, " from

a United Kingdom source", for the percentage of the cost at various stages of manufacture and distribution that the cost of the raw wool represents.

	Raw Wool Represents Per cent.	*Other Costs Per cent.*
In tops	85·0	15·0
In yam	50·0	50·0
In cloth	30·0	70·0
Wholesale price	11·6	88·4
Retail price	8·3	91·7

Converting these percentages to money values on the basis of raw wool costing 30*d*. per lb. clean scoured, the following cost structure is obtained per pound of material:

Raw wool (clean scoured)	2/6
In tops	2/11
In yam	5/–
In cloth	8/4
Wholesale price	21/9
Retail price	30/–

These figures are in close conformity to the writer's experience of prices at the various stages of manufacture and distribution. The most striking feature is the addition of 250 per cent. for "wholesaling". This will be discussed later. The point to be made here is the small effect on the retail price that would accompany even a 50 per cent. reduction in the price of the raw material.

Review of Research Proposals.

Having these facts in mind, let us now examine critically the statements and proposals of Clunies Ross.[1] Clunies Ross sets out to make a case for a comprehensive and ambitious research organization devoted to the salvation of the wool industry of Australia. He discusses in detail research in two fields, (*a*) production or biological research, and (*b*) processing and manufacturing or technical research, but says little about the field which would appear to be of crucial importance—economic research.

It would seem that, all things considered, both the production and manufacturing phases of the textile industry are highly competitive and reasonably efficient, but one is violently arrested by the apparent inefficiency of the distribution phase of the industry. No doubt there is room for improvements in production techniques and for a certain amount of reorganization, and rationalizing of processing and manufacture, but these two fields together account for only about one-third of the costs to be borne finally by the consumer.

Biological Research.

The proposed programme of biological research is directed towards (*a*) improving the quality of wool and (*b*) lowering costs of production. It is assumed that increasing the "quality" of wool (a term that is not defined, and one that is relative to the purposes for which the wool is used) and lowering the costs of production will make a worth-while difference to the demand for wool. To anyone familiar with the way wool of various grades and types is used at present in the various processes of manufacture, it is by no means certain that the improvement in "quality" (whatever is meant by the term) would have this result. If improving quality means producing more fine wool uniform in length and fibre diameter, it is conceivable that it might glut the demand for this type (normally used for the production of "luxury" goods) which has already been largely displaced from the "hosiery" trade and eclipsed by synthetic textiles. If quality means the production of wool uniform in length and diameter irrespective of fineness, its improvement could only benefit the worsted

trade, as the woollen trade (which is much more important quantitatively) has no use for such attributes. If quality means such impalpable things as "handle", it is questionable whether the term is not synonymous with fineness and uniformity. If "quality" is associated with high frequency of crimps, then most breeders in Australia are at present conscientiously selecting away from it.

The trends apparent just before the war were (*a*) that all wool of all qualities was going into consumption and being used for a very wide variety of purposes ranging from fine, light-weight, luxury textiles to carpets, floor coverings and tapestries, and (*b*) that it was the finer, high-grade types that were languishing in price and in demand. It would seem that the demand today is rather for a wide variety of types of keratin fibres and that our aim should be to produce as much of this fibrous keratin as cheaply as possible, maintaining as much "quality" in it as it pays the producer to sustain.

In his discussion on lowering the costs of production Clunies Ross uses many arguments open to criticism. His primary statement that our knowledge of how to control environment and heredity is fragmentary, in so far as it concerns sheep and wool, hardly takes into full account the fund of information gained in the last decade. It is true that we have little detailed knowledge of the inheritance of attributes of great economic importance—nor have we for any farm animal—but we do possess sufficient general knowledge of the principles of breeding to give us a most powerful tool for the selection and propagation of those qualities.

Environment is to a large extent dependent on climate and outside our control, but very substantial increases in our knowledge of the nutritional requirements of sheep and the means of meeting them economically have been made in recent years. Clunies Ross says we can grow more wool if we can give our present sheep more and better food, which is true, but this additional food is almost certain to be more costly than that readily available to them and, moreover, why grow more wool if we are already worried about the disposal of our present clips? Is not one of the strongest justifications for the existence of the wool-growing merino sheep based on the fact that it is specially adapted to convert pastures, that would have little or no economic value exploited in any other way, into meat and fine wool? The richer pastures and more fertile land are usually utilized more intensively. Recent work has shown that wool growth is limited to the amount of digestible protein in the feed and that it tends to be less efficient at the highest levels of protein intake. It is conceivable that, as with the dairy cow, the most efficient production is obtained at the moderately high level of production. Moreover, should we not think more in terms of wool per acre than wool per sheep? Two small sheep may well be maintained, in some environments, on the same area as one big sheep and produce more wool.

The desirability of continuing and even extending biological research on sheep and wool growth, more or less along the lines on which it is at present undertaken, i.e. through the Council for Scientific and Industrial Research and other agencies, is not questioned, but one views with some concern the proposal to set up one all-embracing research organization located in one centre and far removed from the varied problems of such a large area as Australia. The need for such an institution to conduct research into manufacturing techniques and to explore new uses for wool is undoubted. The need for research into the economics of distribution and sales organization of woollen textiles not only seems to offer very great scope but appears to be long overdue. But it is very doubtful whether such an institution should concern itself with research in the field of production. The list of biological problems suggested by Clunies Ross do not appear to be particularly well chosen. There is already a great deal of information from which to assess the nutritive value of Australian grasses and herbage, and more knowledge is accumulating. Studies are being made at present on the influence of sheep and systems of management on the composition of pastures, and on fleece production. The relative economic returns

from various types of management in any case are usually acutely assessed by the grazier, whose business it really is. It is his job, too, with the guidance of qualified advisers, to select the strain of sheep most suited to his environment, although he has not always done it particularlt well. There is considerable knowledge, also, of the most satisfactory ways of assessing wool density and wool fineness. Many very able scientists have devoted much time to this difficu.t task. " Handle " may well be synonymous with finess and uniformity. Much confusion has arisen over this attribute in the past owing to the error of estimating fineness by crimp. Bosman[3] and Lang[7] have shown the fallacy of using crimp as a guide to fineness.

Research into Processing and Manufacture.

The proposal for a well organized and equipped institution for research into processing and manufacture and, it is hoped, into the economics of distribution and sales organization, is most timely and welcome. The two things most likely to stimulate the consumption of wool are (*a*) low priced materials of good serviceable quality and (*b*) varied and attractive new materials.

It should be possible to dispose of very great quantities of wool by concentrating on relatively few types of good standard fabrics, like blue serge, grey flannel or cream blankets, and manufacturing them in such large quantities that they can be turned out very cheaply. Indian and Japanese manufacturers of cotton goods outsold the British firms in pre-war days by turning out good standard cloths in great quantities from rationalized mills at very low cost. These goods could be sold at such a low price that they were assured of a market. Moreover, by this means very great amounts of raw material went into consumption. It may be possible to effect the increased consumption of wool by similar means. Any improvement in processing, manufacturing technique and organization or methods of distribution would assist in lowering the price to the consumer and so encourage increased consumption.

The other way of promoting the use of wool is to increase the variety and attractiveness both of all-wool fabrics and mixtures and by eliminating the disadvantages commonly associated with woollen textiles. A great deal has already been achieved in these directions in recent years, but there is no reason why still further progress may not be made. These materials would, in most cases, be rather more expensive and would appeal to, and be bought by, the more affluent purchaser.

Clunies Ross makes well the point that wool manufacturers have no strongly vested interest in wool to the exclusion of other wool-like fibres. It is certain that they would quickly adapt their factories to the manufacture of other materials into textiles if it profited them to do so. It already appears that textiles of the future will consist more and more of mixtures of various fibres. The wholesaler or retailer has no strongly vested interest in woollen goods as distinct from other textiles and materials. It is the woolgrower whose interests are most closely bound to wool. No longer can he concern himself solely with problems of production. He has a vital interest not only in processing and manufacture but, most particularly, in distribution. If the trend of the future is to dilute the amount of wool in fabrics with synthetic fibres, then he has a particular interest in seeing that those textiles are offered to the consumer at the lowest possible price and the total turnover is raised to such a level as will continue to absorb eagerly all the wool produced.

In the past, the interest of most woolgrowers has been confined to production, a few have carried it forward into processing and manufacture, but virtually none have carried it vigorously into the field of distribution. It may be that it would pay the woolgrowers of Australia to form a corporation strong and large enough to enter the wholesale field if that were necessary to reduce the heavy costs which appear at present to be exacted for this service.

Conclusions.

It would seem that distribution costs are at present the greatest impediment to substantial reduction in the price of woollen goods to the consumer. Increased efficiency in production can be completely vitiated by them. Technical research may promote economies or improvements in manufacturing, but it is most likely to increase the demand for wool by increasing the range and attractiveness of fabrics and by overcoming some of the disabilities from which wool at present suffers. The interests of Australia dictate that both economic research and research into processing and manufacturing should be initiated and developed with the utmost energy and resources. Biological research in the field of production is already being carried out as effectively and efficiently as the number of trained personnel available permits. There is room for considerable expansion of this work, but there is much to be said in favour of effecting this through the organization of the Council for Scientific and Industrial Research and other agencies rather than through a central institute of wool research that would be fully occupied by investigations into the other two fields. Research on the production side cannot hope substantially to improve the competitive strength of wool with synthetic fibres, by lowering the price of the goods to the consumer through a reduction in price to the producer ; it may result in more wool being better adapted to existing or new processes of manufacture.

In the future wool will stand or fall by its intrinsic attributes. When they can all be embodied in a synthetic fibre that can be produced more cheaply, an irreversible decline in wool use and production will set in, and nothing Australia can do will permanently arrest it. At present, not one of the synthetic fibres possesses all the attributes of wool, and although they can be blended with it and used as substitutes for it, wool is still generally preferred for many purposes and it is not inconceivable that new uses will be found for it.

If the world follows the policy of an expanding economy it is not hard to visualize a tremendous increase in the demand for not only clothing textiles of all types but also for carpets and floor coverings, tapestries and furnishings, that might well make present supplies of wool inadequate.

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TECHNICAL NOTES

VARIETAL RESISTANCE TO HALO BLIGHT IN BEANS.

In a small-scale bean variety trial at the Summerleas Horticultural Experiment Station in Tasmania, some interesting reactions were observed following a natural infection by the Halo Blight bacterium, *Pseudomonas medicaginis* var. *phaseolicola*.

A number of varieties were severely affected whilst others showed no symptoms of infection. The resistance of certain varieties to this disease is well-known and the popularity and success of several recent introductions have been largely attributable to this characteristic. Physiological resistance to Halo Blight was demonstrated by Jensen and Goss (Phytopath., 32 : 246-253, 1942) and the following field observations provide in a small way rather striking evidence in this respect. The disease rating is briefly summarized in Table 1.

TABLE 1.

Resistance and Susceptibility to Halo Blight of Bean Varieties.

Row.	Variety.	Disease Rating.*	Remarks.
1	.. Little Navy.	o	
2	.. Staley's Surprise.	++	Pods moderately affected.
3	.. Burpee Stringless.	++++	Scorching of foliage.
4 (part) ..	.. New Discovery.	+	
4 ,, ..	.. Granda.	+	
4 ,, ..	.. Brittle Wax.*	++	Red halos on pods.
4 ,, ..	.. Startler.*	+	
5	.. Tweed Wonder.	++++	Some plants died out.
6	.. Hawkesbury Wonder.	o	
7	.. Wellington Wonder.	+++++	Severe scorching of foliage.
8 (part) ..	.. Black Wonder.	+	
8 ,, ..	.. Clarendon Wonder.	o	
8 ,, ..	.. Hawkesbury Wonder.	o	
8 ,, ..	.. Wellington Wonder.	++++	Some plants died out.
9	.. Brown Beauty.	++++	Many plants died out.
10	.. Canadian Wonder.	+++++	Large number of plants died.
11	.. Refugee.	+++	Pods not severely affected.
12	.. Light Blue Lake Navy.	o	

* o = no infection ; + = infection, the number of plus signs indicating the severity of infection ; * germination only fair.

The area which had never previously grown French beans, was sown in mid-November, and observations recorded on the 14th of January revealed that the variety Brown Beauty in Row 9 was the first to show definite symptoms of the disease, indicating a seed-borne infection. The next rows to show infection were 5 and 7, and a few days later Row 10—i.e. the varieties Wellington Wonder, Tweed Wonder and Canadian Wonder respectively. It will be noted that the intermediate rows, 6 and 8—i.e. Hawkesbury Wonder and Clarendon Wonder—had been apparently by-passed. By the 21st February, the whole area was showing infection with the exception of Row 1 (Little Navy Bean), Row 6 (Hawkesbury Wonder), Row 8 (parts planted with Clarendon Wonder, Hawkesbury Wonder) and Row 12 (Light Blue Lake Navy).

The final observations from which Table 1 is compiled were made on the 17th March. From this table it will be seen that the varieties Little Navy Bean, Hawkesbury Wonder, Clarendon Wonder and Light Blue Lake showed no sign of infection ; the varieties Staley's Surprise, New Discovery, Granda and Black Wonder showed

mild to moderate infection, and the varieties Burpee's Stringless, Tweed Wonder, Wellington Wonder, Canadian Wonder, Brown Beauty and Refugee severe infection.

Because of the random distribution of the rows showing severe infection, it may be assumed that there was a fairly even distribution of inoculum, and the reactions of the varieties can be taken as a good indication of their resistance to this disease under Tasmanian conditions.

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PRESERVATION OF TUBE CULTURES OF FUNGI AND BACTERIA WITH LIQUID PARAFFIN.

In April, 1943, Sherf (Phytopath., 33 : 330-332, 1943) published the results of trials with liquid paraffin as a culture preservative. He found that cultures of *Phytomonas sepedonica* (bacterial ring-rot of potatoes), *P. medicaginis* var. *phaseolicola* (halo blight of bean), and *P. phaseoli* (common blight of bean) remained viable up to 18 months when the tubes were simply filled above the level of the slant with sterile paraffin and stored away. In addition, the fungi *Fusarium eumartii, F. oxysporum, F. avenaceum, F. lycopersici* and *Alternaria* sp. remained viable for six months, which was the extent of the test. These results were so interesting that a trial of the method was commenced, using the species that happened to be on hand.

On August 24th, 1943, week-old cultures of the following organisms were covered with commercial paraffin which had been sterilized in the autoclave : *Pleospora herbarum* Pers., *Pleospora rehmiana* (Staritz) Sacch., *Pseudoplea trifolii* (Rostr.) Petr., *Colletotrichum trifolii* Bain and Essary, *Ascochyta imperfecta* Peck., *Vermicularia* sp., *Fusarium* sp., *Macrosporium* sp., *Rhizobium* from *Medicago scutellata*.

The tubes were then stood in a beaker and left in a corner of the window-sill for six months. Control cultures without paraffin were placed beside them. On March 10th, 1944, they were examined and subcultured. The control cultures at this date were, of course, shrivelled and useless. The cultures under paraffin appeared as fresh as the day they were made. The agar appeared new, and the organisms had apparently remained perfectly static since the paraffin was added. Viability was not affected since subcultures of all the organisms immediately grew vigorously.

The simplicity and cheapness of the technique and its remarkable effectiveness warrant its trial by plant pathologists with organisms belonging to other groups. Should it be effective with most organisms commonly cultured, as seems likely, its regular use for culture preservation should be a boon. The saving in time and material made by eliminating the necessity for frequent subculture of stock specimens should be very great. This is of particular importance in war time. Another important advantage which the technique would appear to have is automatic control of that troublesome pest the culture mite. Although opportunity to test this point has not occurred it is most improbable that the mites would be able to survive in the culture under paraffin. The only disadvantage of the method is the necessity to keep all tubes upright in racks, but this is of minor importance when the advantages are weighed against it.

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THE GENERIC NAMES OF BACTERIAL PLANT PATHOGENS.

The time is much overdue for the adoption of a uniform terminology in generic names of bacterial plant pathogens by all agricultural scientific workers. This note is written with the hope of attaining this uniformity in Australia. That the generic names of bacterial plant pathogens quoted in the literature are both confusing and illogical is recognized by all familiar with publications on plant diseases. The amended generic names suggested recently by Dowson[1, 2, 3, 4] seem to provide the most logical solution to this problem. These genera are *Corynebacterium* Lehmann and Newmann, *Bacterium* Ehrenberg emend Dowson, *Pseudomonas* Migula emend Dowson, and *Xanthomonas* Dowson. They constitute a natural grouping with bacteria other than plant pathogens which is always to be preferred to an artificial grouping. The relationships of these genera to previous nomenclatures are set out in Table 1.

TABLE 1.

Nomenclature of bacterial plant pathogens.

Author.	Gram-Positive. Non-Motile.	Gram-Negative. Motile.		
		Tuft of Polar Flagella.	Single Polar Flagellum.	Peritrichous Flagella.
Migula ..	*Bacterium.*	*Pseudomonas.*	*Pseudomonas.*	*Bacillus.*
Smith ..	*Aplanobacter.*	*Bacterium.*	*Bacterium.*	*Bacillus.*
Bergey ..	*Phytomonas.*	*Phytomonas.*	*Phytomonas.*	*Erwinia.*
Dowson ..	*Corynebacterium.*	*Pseudomonas.*	*Xanthomonas.*	*Bacterium.*

The inconsistencies of the previous generic naming of bacterial plant pathogens have been pointed out quite clearly by Dowson. For the benefit of readers who have not had the opportunity of viewing this literature, the following are the chief points favouring the adoption of Dowson's amended generic names. Bergey placed both non-motile and motile, and what is more important, Gram-positive and Gram-negative bacteria in the same genus *Phytomonas*. It is a well-recognized fact amongst bacteriologists that the Gram-staining reaction is in reality a reflexion of a fundamental difference between the proteins of the two groups of organisms which are therefore considered to be not closely related. The Gram-positive bacteria of Bergey's genus *Phytomonas* are placed in the genus *Corynebacterium* by Dowson, because Jensen[5] was able to show a common relationship of some soil saprophytes and the plant pathogens *Phytomonas insidiosum* and *Phytomonas michiganensis* to *Corynebacterium diphtheriae*.

Dowson has grouped the Gram-negative bacteria of Bergey's genus *Phytomonas* into two genera. These are *Pseudomonas*, of Migula, for green, fluorescent bacteria with a tuft of polar flagella and *Xanthomonas* for the yellow forms of Migula's *Pseudomonas* with a single polar flagellum.

The genus *Erwinia* erected by the American Society of Bacteriologists and used by Bergey should be replaced by the genus *Bacterium* for the following reasons advanced by Dowson. The genus *Erwinia* " was created on one character alone, that of pathogenicity to plants." All the other characters of this genus are equally applicable to the colon bacillus *Escherichia* and to the genera *Eberthella* and *Salmonella*. These also agree with Ehrenberg's genus *Bacterium*. Dowson states that " the names *Bacterium salicis*, *B. coli*, *B. typhosum* and *B. enteritidis* undoubtedly provide more information about these four organisms than do the names *Erwinia salicis*, *Escherichia coli*, *Eberthella typhi* and *Salmonella enteritidis*. The specific epithets tell us that the organisms are connected with willows, the large intestine, typhoid fever and enteric fever respectively, but whereas in the first series the use of

the single generic name implies that all four bacteria are closely related, in the second series no such relation is indicated and the generic names merely commemorate four distinguished bacteriologists. For these reasons I consider that the generic names *Erwinia, Escherichia, Eberthella* and *Salmonella* should be rejected and replaced by *Bacterium.*" Bacteria belonging to the emended genus *Bacterium* have peritrichous flagella.

The generic naming suggested by Dowson for bacterial plant pathogens has been adopted in Tasmania and the following key to these amended genera was developed by the writer and used successfully during the past season.

Bacterial Rods, No Endospores, Motile or Non-Motile.

A. Gram-positive :

Rods, often club- or wedged-shaped, non-motile, not acid fast. " Snapping " action by dividing cells. No endospores..... *Corynebacterium*

B. Gram-negative :

Rods, motile or sometimes non-motile.

(i) Flagella peritrichous.

Greyish or transparent on nutrient agar. Creamy yellow on potato. Acid and gas on salicin. No acid on lactose..... *Bacterium*

(ii) Flagella Polar :

(*a*) Tuft of polar flagella. Greenish-white and fluorescent on nutrient agar. Creamy pink on potato. Always motile. No acid on salicin. No acid on lactose..... *Pseudomonas*

(*b*) Single polar flagellum. Yellow on nutrient agar. Yellow on potato. No acid on salicin. Acid on lactose..... *Xanthomonas*

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SOME EFFECTS OF WAXING ON WEIGHT LOSS FROM ORANGES AND CERTAIN VEGETABLES.

During the course of extensive investigations which have been carried out by the authors at the Council for Scientific and Industrial Research Food Preservation Laboratories, Homebush, N.S.W., on the effects of skin coatings of various types, mainly wax and oil emulsions and alcoholic solutions of castor oil and shellac, on the behaviour of fruits and vegetables during storage, considerable attention has been paid to the effects on shrinkage or weight loss. Such weight loss is of considerable economic importance, as oranges for instance may lose ten per cent. of their weight in a week at summer temperature while carrots may lose ten per cent. of their weight in a day or two during summer months. It was found that wax emulsions were more effective in reducing weight loss than oil emulsions or alcoholic solutions of castor oil and shellac. A commercial wax emulsion* was found to be very effective in reducing weight loss and some experiments to determine the effects of the concentration of this emulsion on the degree of reduction in weight loss were carried out in 1943 with oranges, carrots, turnips, cucumbers and potatoes.

Results.

Oranges. Navel oranges were purchased in the market in July and units of twelve oranges were treated with various concentrations of the wax emulsion and stored in trays at 65° F. and at 86° F. after randomizing in a twelve by twelve latin square lay-out. After nineteen days at 65° F. and ten days at 86° F. the experiment was terminated and the losses in weight were as follows.

Treatment.	Per cent. Weight Loss.		Per cent. Reduction.	
	65° F.	86° F.	65° F.	86° F.
Control	17·2	20·0	0	0
2·5% wax	9·4	11·2	45	44
5·0	6·9	7·2	60	64
7·5	5·6	6·0	67	70
12·5	3·9	4·2	76	79
15·0	3·7	5·2	77	74

Carrots. Two experiments with Intermediate type carrots were carried out.

(*a*) In the first experiment carried out in July the treatment unit was eight roots and the treated roots were randomized and held on trays at 65° F. for eighteen days when the losses in weight were as follows:

Treatment.	Per cent. Weight Loss.	Per cent. Reduction.
Control not washed ..	36·7	8
Control washed	40·1	0
5·0% wax	36·8	8
7·5	27·9	30
10·0	25·7	36
12·5	26·0	35
15·0	22·0	45

Figure 1 shows the appearance of carrots, unwaxed and waxed (10% emulsion) after 15 days at 65° F.

(*b*) In the second experiment, carried out in October, the carrots were held at a temperature of 86° F. and, as the humidity was somewhat low (45% R.H.), weight loss was rapid.

The losses in weight after three days were as follows:

Treatment.	Per cent. Weight Loss.	Per cent. Reduction.
Control not washed ..	32·2	23
Control washed	42·1	0
5·0% wax	31·8	24
7·5	27·1	36
10·0	23·2	45

* Brytene 6170, manufactured by Hardie Trading Co., Melbourne.

Purple Top White Turnips. One experiment with these was carried out during July with a unit of eight roots. After eighteen days at 65° F. the losses in weight were as follows :

Treatment.	Per cent. Weight Loss.	Per cent. Reduction.
Control washed	30·5	0
5·0% wax — —	21·8	28
7·5	18·7	39
10·0	15·0	50
12·5	13·1	57
15·0	13·8	54

Cucumbers. An experiment with long green type cucumbers was carried out in April, with a unit of eight fruits. After twelve days at 65° F. the weight losses were as follows :

Treatment.	Per cent. Weight Loss.	Per cent. Reduction.
Control	4·3	0
5·0% wax	1·9	55
10·0	1·5	65

Potatoes. At various times experiments have been carried out with potatoes but in each instance skin coatings have had no effect on the rate of weight loss. It was thought that waxing may be effective with new potatoes. Accordingly some new clean Factor potatoes were treated in May on the day following digging, some being stored at 65° F. and some at 45° F. After twelve weeks at 65° F. and nineteen weeks at 45° F. the weight losses from untreated and waxed potatoes were as follows :

	Per cent. Weight Loss.	
	65° F.	45° F.
Control washed	5·8	3·6
10% wax	5·2	3·4

Discussion.

The loss in weight during storage from oranges, carrots, turnips and cucumbers was considerably reduced by dipping them in a wax emulsion and allowing them to dry by free exposure to the air. With potatoes no significant effect of waxing on weight loss was observed. It is apparent that the effectiveness of the coating varies with the type and condition of the produce treated and with the concentration of wax. These results are illustrated in Figure 2.

A ten per cent. concentration would have reduced weight loss from the oranges by about seventy per cent. and reduced weight loss from the cucumbers by sixty-four per cent. The reduction for the turnips was fifty per cent. and for the carrots about forty per cent. The results with the oranges agree well with results from previous unreported experiments.

Although the carrots and turnips used were all obtained fresh from the markets, there was a considerable variability in the effectiveness of the waxing. In two unreported experiments ten per cent. wax reduced weight loss from carrots and turnips held at 65° F. by fifty per cent. and thirty-five per cent. respectively. Figure 2 shows the differences in condition between an untreated carrot and one treated with ten per cent. wax, resulting in a fifty per cent. reduction of weight loss. Platenius[2] found that the effectiveness of waxing was much less with stored than with fresh carrots. Thus the effectiveness of the coating will depend to a large extent on the condition of the material at the time of treatment and it is probable that for maximum benefit the produce should be waxed as soon as possible after harvesting. It has been found at this laboratory that the rate of weight loss from untreated fruit and vegetables falls off considerably with time after harvesting.

It is difficult to explain why waxing has not been effective in reducing weight loss from potatoes since, in common with most fruits and vegetables, loss in weight from potatoes is due almost entirely to the evaporation of water.

Figure 1.
Carrots held for 15 days at 65° F. unwaxed (left) and waxed with 10% emulsion (right).

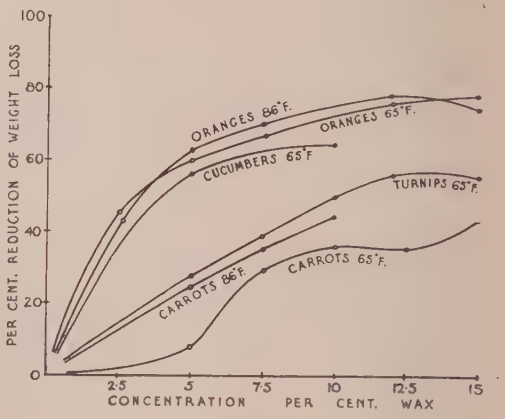

Figure 2.
Effect of concentration of wax emulsion on the percentage reduction of weight loss.

Assuming that an effective reduction of forty per cent. in rate of weight loss would be satisfactory commercially, a concentration of only 2·5 per cent. of wax would be satisfactory for oranges. In the case of turnips and carrots it seems that the most effective concentration consistent with cost would be between 7·5 per cent. and ten per cent. wax. It was found that washing the roots increased the rate of weight loss from carrots and that the application of a five per cent. concentration of wax was necessary to offset this effect. In the case of cucumbers, besides reducing weight loss, waxing considerably retarded yellowing. After twelve days at 65° F. the untreated cucumbers were yellow, soft and unfit for consumption, whereas those treated with ten per cent. wax emulsion were green, firm and quite palatable. This effect was also observed by Platenius[2] with cucumbers and we have found that with apples,[1] the retention of the green skin colour is one of the principal advantages of the use of skin coatings.

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The Australian Institute of Agricultural Science

MEETINGS OF COUNCIL.

A meeting of Council was held at the Department of Agriculture, Melbourne, on 14th March, 1944. *Present.*—Mr. J. A. Aird (V.), in chair, Dr. A. E. V. Richardson (S.A.), Dr. H. C. Forster (W.A.), Mr. G. H. Vasey (N.S.W.), Mr. J. L. Provan (Qld.), Mr. F. S. Crawford (Tas.), and the Hon. Secretary, Mr. A. J. Vasey.

The following applicants were admitted to corporate membership: T. M. Jensen, M. A. Cummings, J. Keane (Vic.), E. J. Hilder (W.A.), J. H. Taylor (N.S.W.) and T. Gould (A.C.T.). The following transfers were also recorded: Dr. R. C. Hutchison (Qld. to N.S.W.), Mr. C. S. Christian (Qld. to A.C.T.), Mr. K. Woodroffe (Vic. to S.A.), and J. F. Kennedy (Vic. to Qld.).

At the Council meeting, held at the Department of Agriculture, Melbourne, on 8th May, 1944, Mr. R. A. Boyle was welcomed as the new chairman of the Proxy Council. Those present included Dr. A. E. V. Richardson (S.A.), Dr. H. C. Forster (W.A.), Mr. J. L. Provan (Qld.), Mr. R. W. Prunster (A.C.T.), Mr. F. S. Crawford (Tas.), the Hon. Treasurer, Mr. R. L. Twentyman, and the Hon. Secretary, Mr. A. J. Vasey.

The following were admitted to corporate membership: Mr. N. T. Flentje and Miss H. M. Ferres (S.A.). The following inter-branch transfers were recorded: Messrs. L. C. Holmes, C. M. Donald (N.S.W. to Vic.), Mr. J. M. Vincent and Dr. J. R. A. McMillan (A.C.T. to N.S.W.), Mr. F. Hely (A.C.T. to Qld.) and Mr. G. D. Hubble (Qld. to Tas.).

The per capita rebate to Branches for 1943 was fixed at 5*s.* 6*d.* per financial corporate member or member on war service. The balance at bank as at 8th May was £294 17*s.* 5*d.*

The report of the Business Manager of the Journal, Dr. N. S. Noble, which will be published in a later issue of this Journal, was received.

The proposal for a general meeting in 1944 was conveyed by the Hon. Secretary from the South Australian Branch. It is suggested that a three-day meeting be arranged, the agenda to include discussions on technical subjects.

On behalf of the Victorian Branch, Mr. R. A. Boyle moved: that this Branch requests Council, acting under clauses VI-IX of the Memorandum of Association, to give immediate consideration to a plan for post-war betterment of salaries and conditions of employment and invites the support of other Branches. Dr. Forster and Mr. A. J. Vasey were appointed to examine the report of the previous Status and Salary Survey (1939-40) with a view to bringing it up to date as a basis for a submission to the Rural Reconstruction Commission.

The Hon. Secretary intimated his wish to resign from that position as from 31st December, 1944, when he would have completed ten years' service to the Institute in that capacity.

MEETINGS OF BRANCHES.

Australian Capital Territory Branch.

The annual general meeting of the A.C.T. Branch was held on the 29th March, 1944. The following office-bearers were elected for the coming year: President and Delegate, Dr. C. Barnard; Honorary Secretary-Treasurer, Mr. W. M. Willoughby; Sub-Editor, Mr. F. J. Gay; Committee, Miss N. Barrie, Dr. J. G. Bald, Mr. K. Loftus Hills, Mr. R. Roe.

In place of the customary presidential address, the retiring President, Dr. Bald, led an interesting and lively discussion on "The Ideal Organization of Agricultural Research in Australia".

New South Wales Branch.

The main business of a meeting, held at Science House, Sydney, on 10th March, 1944, was an illustrated address by Dr. C. J. Magee, Acting Chief Biologist of the N.S.W. Department of Agriculture, on "A Survey of the Deterioration of Service Equipment under Tropical Conditions". After outlining the circumstances which led to the survey being undertaken, Dr. Magee indicated the climatic causes of the problems and the particular problems which arose. These included corrosion of metallic surfaces, mould attack on fabric and wooden materials, collapse of the soles of boots, and mould growth on the lenses and prisms of optical instruments. It was pointed out that the problems of the tropics were almost exclusively related to the exclusion of moisture and control practices took the form of moisture-proofing wherever possible. Where it was impracticable to keep moisture out, suitable fungicides were introduced.

The meeting held at the School of Agriculture, Sydney University, on 19th May was a joint meeting with the Sydney University Agricultural Graduates' Association to consider the report of a Joint Committee of the two bodies, reviewing the Agricultural Science Course at Sydney University. Recommendations were made regarding the improvement of practical work and some courses of study, and increasing the number of subjects for specialization in Fifth Year. The urgent need for the establishment of adequate post-graduate study, of facilities for refresher courses, and for the expansion of teaching staff was expressed. It was decided that the recommendations should be placed before the Faculty of Agriculture.

Queensland Branch.

The following Branch Committee was elected at the annual general meeting: President, Mr. C. R. von Stieglitz; Vice-Presidents, Mr. W. A. T. Summerville and Mr. C. J. McKeon (President-elect for 1945); Hon. Secretary-Treasurer, Mr. C. W. Winders; Sub-Editor, Mr. C. G. Hughes; additional members, Messrs. A. F. Bell and A. R. Brimblecombe and Dr. D. A. Herbert. The financial statements presented showed a credit balance at 31st December, 1943, of £23 14*s.* 3*d.* The excess of assets over liabilities was £72 12*s.* 9*d.*, including war savings certificates valued at £39 7*s.* 6*d.*

The presidential address by Mr. W. A. T. Summerville on Horticultural Development in Queensland is published elsewhere in this issue.

South Australian Branch.

The eighth annual general meeting of the South Australian Branch was held on 31st March, 1944. The following office-bearers were elected for 1944: President, Mr. J. K. Taylor; Vice-President, Mr. H. G. Andrewartha; Hon. Secretary, Mr. A. T. Pugsley; Hon. Treasurer, Dr. C. S. Piper; Sub-Editor of Journal, Dr. T. J. Marshall; Committee members, Mr. R. I. Herriot, Prof. H. C. Trumble, Mr. K. Woodroffe; Member *ex officio*, Mr. D. B. Adam.

The retiring President (Mr. D. B. Adam) delivered his presidential address, " A brief review of Institute activities and some remarks on ' Education and Country Life ' ".

Mr. Adam pointed out some of the difficulties that the Institute was facing during the present war years, and felt that many of these could be overcome when they could be discussed by members at a full general meeting of the Institute. He expressed the hope that it would not be long before these meetings and also those of the Australian and New Zealand Association for the Advancement of Science were resumed.

Education was discussed from its two aspects—formal education and informal or adult rural education. The university course should be designed for the professional occupations—extension, teaching and research, with administration in each. With this in view the training should be aimed at providing, firstly, a sound and liberal education, and secondly, the acquirement of a professional skill and agricultural outlook. Informal education should aim at introducing culture into our rural life. Mr. Adam gave two examples of how this had been accomplished: the Danish People's High Schools, which played such a great part in the progress of Denmark, and the village colleges of Cambridgeshire where the community's social life has been built around the rural school.

Victorian Branch.

The ninth annual meeting of the Victorian Branch was held on 23rd March, 1944. At the time of the meeting membership totalled 150. Eleven new members were admitted during the year and there were eight inward and four outward transfers. The financial position, showing a credit balance of £36, was regarded as very satisfactory. Two meetings were arranged by the Branch, and members attended six more arranged by the Melbourne University Agricultural Society. Messrs. J. A. Aird, R. A. Boyle and A. W. Jessep were added to the Manpower Advisory Sub-committee. During the year the Branch submitted evidence to the Rural Reconstruction Commission on agricultural education and the Branch committee cooperated with the professional division of the Public Service Association in asking the Minister for Agriculture that officers employed under the Agricultural Education Act should be given permanent appointments after an appropriate probationary period. Between 30 and 40 branch members were directly concerned.

Office-bearers elected for the ensuing year were: President, Mr. R. A. Boyle; Vice-president, Mr. L. C. Bartels; Immediate Past President, Mr. J. A. Aird; Secretary, Mr. W. D. Andrew; Treasurer, Mr. C. E. Cole; Sub-Editor, Mr. F. S. Crawford; Committee, Messrs. T. H. Atkinson, J. A. Baker, A. C. T. Hewitt, Dr. H. C. Forster and Prof. S. M. Wadham.

Moving pictures were presented by the Victorian Department of Agriculture.

On 28th April, members attended the twenty-second annual meeting of the Melbourne University Agricultural Society to hear Dr. Forster's presidential address, " War Agricultural Committees—Their Part in War-time Agriculture ".

Mr. W. J. B. McDonald was elected President for 1944. Vice-Presidents elected were Mr. R. T. M. Pescott and Mr. A. A. Lee, and the secretary, Mr. H. R. Webb. Membership at 31st December, 1943, was 187, including 130 Melbourne graduates in Agricultural Science and 35 other graduates.

Western Australian Branch.

The ninth annual general meeting of the Western Australian Branch was held on the 31st March, 1944, and was devoted mainly to formal business.

The annual report showed that at 31st December, 1943, there were 59 corporate members and ten students. Seven of the corporate members were on service with the armed forces. The financial statement showed a satisfactory balance at the bank. The following office-bearers were elected for the ensuing year: President, Mr. R. P. Roberts; Vice-President, Mr. G. H. Burvill; Past-President, Mr. W. P. Cass-Smith; Hon. Secretary, Mr. R. J. Moir; Hon. Treasurer, Mr. G. R. W. Meadly; Sub-Editor, Mr. N. McKeown; Committee members, Messrs. M. Cullity, H. R. Powell, G. F. Melville and R. C. Rossiter; Hon. Auditors, Drs. L. W. Samuel and E. J. Underwood; Student Representative (elected by student members), Mr. G. Haplin. Professor G. A. Currie, as Federal President for 1944, is also *ex officio* a member of Committee.

On 18th February, 1944, Major B. L. Seabrook, of the U.S. Army Food Production Group, delivered an address on " Large-Scale Vegetable Production " to a general meeting of the branch. The speaker was especially qualified to discuss this subject due to his association with the Seabrook Farms Company, controlling 33,000 acres under vegetables in New Jersey. Half of this area is farmed by contract growers and the rest directly by the company, the produce being handled by canning, freezing and dehydration. Major Seabrook devoted his talk largely to the mechanization of vegetable production illustrating salient features with the assistance of films and filmstrips. He praised the work of Australian agricultural machinery manufacturers who had cooperated in the rapid production of this machinery to the extent that a large amount would be available by mid 1944. This will be allocated to state Departments of Agriculture and machinery pools will be established so that some of the smaller growers can have the use of this type of equipment. Major Seabrook also paid tribute to the remarkable progress which has been achieved in Australia in the past two years with vegetable canning and dehydration.

At a combined meeting arranged with the Western Australian State Committee of the Council for Scientific and Industrial Research held on 28th April, 1944, we were fortunate in having present Mr. A. J. Vasey, Hon. Gen. Secretary to the Institute, Dr. L. B. Bull, Chief of the Animal Health and Nutrition Division of the C.S.I.R., and the Federal President, Dr. G. A. Currie. Visitors from the Australian Chemical Institute, Australian Veterinary Institute, Institute of Surveyors, Royal Agricultural Society, Western Australian Pastoralists' Association, Western Australian stock firms, and an agricultural representative of Western Australian newspapers were also present.

Following a cordial welcome by the Branch President, Mr. R. P. Roberts, Mr. Vasey gave a short address expressing satisfaction with the growth of the A.I.A.S. and the useful work it was performing, underlining the value of the Institute as a medium for exchange of ideas free from departmental restriction. Referring to his recent trip through the agricultural areas of Western Australia with Dr. Bull, Mr. Vasey remarked that he was very favourably impressed with the possibilities offered by the combination of relatively high winter temperatures and light soils. In view of these factors light annual rainfall had less significance. Continuing, Mr. Vasey deplored the fact that, due to the exigencies of war, so many agricultural graduates had been forced into essential services which were divorced from agricultural activity but fervently hoped that they would be redrafted to their rightful occupation to meet the increasing demand for trained agriculturalists.

Dr. Bull addressed the meeting on " Animal Problems ", speaking highly of the work performed in the State in attacking animal diseases and production problems and pointing out that problems encountered in Western Australia were not of isolated significance to that State alone, but were of import throughout the Commonwealth. Furthermore, due to rapid changes in animal husbandry, new difficulties were constantly appearing and could only be efficiently combated if field workers could draw continuously on a fund of knowledge accumulated by the ceaseless work of scientific institutions. Work in this State had opened up many new fields which if followed to their ultimate conclusions might develop beyond our present vision.

As an example of our present incomplete knowledge of more detailed physiology, Dr. Bull gave an interesting account of a sheep disease known as toxaemic jaundice or " yellows " which had become prevalent in the Riverina district of Victoria. This condition was almost entirely confined to the British breeds of sheep and was due to their inherent capacity to store large quantities of copper in the liver, ultimately giving rise to copper poisoning. The Merino is very rarely affected. In contrast, however, dystokia, or difficult lambing which is causing concern in Western Australia at the present time, is almost entirely confined to Merinos. Dr. Bull here uttered a word of warning against indiscriminate use of copper by farmers in this State. The speaker then went on to discuss work now in progress in Australia in connection with the fertility of sheep and concluded by briefly outlining the series of tests which were conducted on Wardang Island, South Australia, to determine the effectiveness of the virus disease myxomatosis for controlling the wild rabbit.

Current Notes and News

" The Queensland Journal of Agricultural Science."

The first number of this new quarterly, intended to record the results of experimental work conducted by officers of the Queensland Department of Agriculture and Stock, was issued recently. The contents of the first number comprise a lengthy paper by W. A. T. Summerville on " Studies in nutrition as qualified by development in *Musa cavendishii* Lambert ", and two papers by N. G. Cassidy entitled, respectively, " Natural waters of the Queensland coastal belt " and " Exchangeable sodium and the physical properties of soils ".

The journal is issued free to scientific, agricultural and veterinary institutions and organizations, the price to other bodies and to individuals being ten shillings per volume.

War Agricultural Committees in Victoria.

In the presidential address to the Melbourne University Agricultural Society on 28th May, 1944, Dr. Forster described the events leading up to the formation of the Committees, together with a brief outline of the Constitution of the Committees in Victoria and the functions as set out in the original decisions of the Standing Committee on Agriculture.

The efficiency of the Committees in Victoria has been due largely to the decision to second for full-time duty with the W.A.C.'s, 19 officers of the Department of Agriculture. Invaluable assistance has also been afforded by the District Inspectors of the Lands Department, a number of whom have assisted local committees on a part-time basis.

Following the first rush of forming the Committees in September, 1942, when over 5,000 nominations for membership were received by the Department, the organization was immediately faced with the major task of preparing for the harvest. An excellent season had resulted in abundant growth of pastures and thus an intensive drive was organized to conserve as much grass hay as possible. Despite man-power and baling wire shortages, the total tonnage baled in 1942 was about double that normally conserved. This later proved invaluable in the dry winter of 1943.

The provision of accommodation for some eight hundred fruit pickers in the Goulburn Valley, the management of the camps and the allocation amongst growers of some 1,500 men directed to this work by the Manpower Directorate was a most onerous task during that first harvest. The difficulties attendant on the use of central camps for large numbers of individuals who were not subject to any central control or discipline influenced the W.A.C. executive in deciding to avoid, if possible, this method of accommodation for the future.

The Goulburn Valley problem was closely followed by the grape harvest in the Mildura-Swan Hill district. Accommodation in this area was provided on the growers' own properties, and despite the much larger number of some 3,600 men and women used in this harvest, no major problems were experienced. The assistance of the local growers' associations in the organization of accommodation and in the handling of the labour was invaluable. Valuable experience in the close supervision and individual handling of a very different type of labour was also gained in the East Gippsland district when some 200 aliens were made available by the Allied Works Council for the harvesting of the sugar beet at Maffra and vegetables at Lindenow.

Early in 1943 a number of Commonwealth Departments controlling various types of materials which were in short supply sought the assistance of the War Agricultural Committees in sponsoring orders on behalf of farmers. Building and fencing materials, welding gas, electricity applications, tractor tyres and ammunition were amongst the items dealt with. The Committees have served one of their most useful functions in thus assisting farmers to obtain release of essential materials necessary for production. Their local knowledge of individual cases is invaluable to the controlling authority.

The control of ammunition provides an interesting sidelight on types of control. During the early months of the war, ammunition for civilians was in short supply and could only be purchased after obtaining a permit. No limit was placed on the number of permits issued, with the result that permits soon exceeded supply and farmers were unable to obtain ammunition to shoot vermin which were becoming a major problem. A more strict control was introduced in July, 1943, whereby normal permits were only given to farmers for a small annual issue of ammunition. Special permits sponsored by the W.A.C.'s were also available for extra supplies when pests were so serious as to warrant special attention. The tighter control thus introduced has ensured all available supply going to the farmer who needs it.

With the intensification of food production plans during 1943, the work of the W.A.C.'s increased materially. The control of machinery releases and the encouragement of machinery pools for small farmers who could not otherwise avail themselves of the benefits of new large-scale machinery have been amongst the major developments.

In planning for the 1943 harvest, provision of manpower has been the biggest problem In conjunction with the Manpower Directorate, many sources have been tapped in an endeavour

to overcome this difficulty. Many volunteer pools have been built up in the larger country towns in which members aid in supplying seasonal labour needs during their week-ends and holidays. Over 20,000 farmers have been interviewed ty the Committees to seek members to form a Rural Pool. In this, farmers indicate the slack periods at which they can be spared from their farms and use is made of their labour for fruit picking, slaughtering and other seasonal work. Over 8,000 applications for releases from the Army for rural work have been individually examined. Prisoners-of-war have also been used, both in small groups of one to three on individual farms and in larger groups working from a hostel. Invaluable aid was given this year when over 500,000 cases of tomatoes were picked by prisoners-of-war at one centre in Victoria.

In reviewing their work it is evident that the Committees, considering the difficulties that they were up against and their lack of experience in administering controls, have performed an excellent task. Many Commonwealth Departments have expressed their satisfaction with the way in which things have been managed. The Committees themselves are very varied in nature—some far more strict in their outlook than others who sometimes tend to recommend without fully investigating cases, while others desire to regulate all types of production. With the passing of time they are gaining much experience in adopting an unbiased judicial attitude and are, therefore, becoming most valuable in this type of work. Farmers themselves, although suspicious of the Committees at the commencement, are now appreciating the value of this type of control, and are seeking their guidance and assistance in overcoming the difficulties which are hindering production.

In closing the talk stress was laid on the possible value of the organization in post-war developments. In the immediate period following the signing of peace it is evident that some controls will be continued, and it is presumed that the Committees will probably continue to operate in their present manner. In the subsequent period of rehabilitation general guidance and assistance to new settlers could be undertaken. The recent bushfires have also demonstrated one method in which an organization such as the War Committees can be most valuable. In Victoria, the distribution of fencing materials has been undertaken in the country districts by the War Committees. Owing to the shortages of supplies, it has been necessary to distribute materials as they come to hand amongst the settlers so that each is provided with sufficient to meet his immediate needs. Emergency measures of this nature can best be undertaken by some local organization such as the War Committees.

Dr. Forster expressed great appreciation of the work of all members of the Committees. The farmers themselves have devoted much time and labour to the work despite great inconvenience to themselves, while the District and Local Chairmen have had to work long hours under very difficult conditions in administering many of the controls. The District and Local Committees have been the front-line shock troops of the organization and many times have had to withstand unfavourable criticism from individuals who have been dissatisfied with present conditions.

Rice Production on the Wakool Irrigation Area.

During the years immediately preceding the war the entire Australian crop of paddy rice, approximately 42,000 tons annually, was produced on the Murrumbidgee Irrigation Area in New South Wales. This production satisfied all local requirements, with an approximate 50 per cent. surplus for export, chiefly to England, but as a result of the greatly increased war-time demand for rice by the Services, the area sown was increased from a pre-war annual average of 23,600 acres to 34,500 acres, the limit set by water supply on the Murrumbidgee Area, during the 1942-43 season. Even with the continued curtailment of civilian rice supplies, the greatly increased crop was expected to fall short of estimated future requirements, as the Commonwealth had also accepted responsibility for supplying rice to the native populations of Pacific islands cut off from their usual sources of supply.

As a result of a conference of all interested parties convened by the Commonwealth Department of Commerce and Agriculture in July, 1943, it was decided to explore the prospects of extending rice production to other irrigation areas. Accordingly, a survey was made in August, 1943, by officers of the N.S.W. Department of Agriculture and the Water Conservation and Irrigation Commission and four 5-acre experimental plots were established, two in each of the Berriquin and Wakool Irrigation Areas, on representative portions of large areas of relatively treeless plain. The sites were chosen for their soil type, proximity to main canals, adequate drainage facilities, ease of preparation and management, and accessibility by road and rail. The results from all four plots, which were harvested about May, 1944, were eminently satisfactory, supporting the decision which was made in the ensuing January to proceed with the preparation of 5,000 acres of land in the Wakool area for sowing in October. This early decision was necessary to enable the assembly of sufficient plant and labour to complete preparation of the land before the commencement of the winter rains, which normally preclude working these heavy soils later than April or May.

The task was undertaken by the N.S.W. Water Conservation and Irrigation Commission. Five thousand acres of land were leased from a sheep station property, 4,100 acres surveyed in detail, scarified, and pegged out for rice bays, each provided with independent watering and

drainage facilities. The plant assembled included 21 tractors, several 8-horse teams, 16 scarifiers, a bulldozer, besides ploughs, scoops, delvers and seed drills. Preparation included the construction of 12⅛ miles of main supply channels, 17½ miles of supply ditches, 5½ miles of drainage channels, 6 miles of drainage ditches, and 164 miles of check banks. The area was ready on time, and 200 tons of seed were required to sow it. As each bay was sown, it was watered and drained again, to induce even germination ; as usual, most of the bays had to be watered several times and drained several times before the water could be left on permanently, about November. An immense amount of painstaking labour was involved in ensuring proper watering and draining, and patrolling and repairing breaks in the check banks.

The crop fulfilled the promise of the pilot plots, although February of this year was unusually cool, and is in process of being harvested with 27 tractor-hauled auto-headers. A total yield of at least 7,000 tons of paddy is expected. One hundred to 180 men have been employed continuously, the latter number for harvesting operations.

A further area of 5,000 acres has been prepared for sowing next season. The entire project is intended only as a war-time measure, under State control, so that it will not interfere with a return to normal production under co-operative control after the war.

Food and Farming in Post-War Europe.

The reconstruction of the peasant agricultural system of Europe is one of the most difficult and perplexing of post-war problems facing the Allied Nations. The politics and economics of European farming have contributed much to the stresses and strains that culminated in the present war and the claims of the peasantry will profoundly influence the policies which European nations will attempt to pursue after the war. It is therefore most opportune that Mr. Lamartine Yates, whose penetrating analysis of European agrarian policy was published in 1940 under the title of *Food Production in Western Europe*, and Miss Warriner, whose *Economics of Peasant Farming* is an authoritative treatise on Eastern Europe, should use their combined knowledge to produce *Food and Farming in Post-War Europe*, which consists essentially of suggestions for positive measures aiming to effectually improve the lot of the farming community of Europe in the post-war period.

The first three chapters are typical of the descriptive analysis of the authors' earlier books, though, of necessity, much more superficial. An attempt is made to outline the pre-war physical, economic and political background of peasant farming. A very intimate picture of the problem is provided by the introduction of four delightful case studies of representative farmers in France, Czechoslovakia, Yugoslovakia and Belgium. One is struck by the high density of population, the inefficient small farms made up of scattered strips, the ignorance and blind conservation of the peasant, the lack of opportunity, the poor nutritive value of their monotonous diet and the poor housing conditions.

Chapters IV to VIII, which sketch the main outline of the proposed reorganization of European farming and suggest the lines of policy which might appropriately be developed, are of a more conjectural and controversial nature. The curse of over-population makes itself felt in the under-employment of the peasants, high land values and cheap labour, thus inhibiting any incentive to mechanize farming. To some extent, these evils could be overcome by industrialization, and provision of a better transport system, without, it is hoped, the privations the Russians suffered to achieve the same ends. In facing the general problem of raising the productivity of farms, the authors look to more intensive agriculture, i.e. market gardening and livestock production in place of cereals, coupled with measures to increase the potential demand for more nutritious foodstuffs. It is possible that here a closer examination of the proposals put forward, with special reference to the European environment, would have been merited. For instance, proposals for a Food Stamp Plan and the Danubian counterpart of the Tennessee Valley Authority appear to be glibly put forward as if such schemes could be adopted without any substantial modification. It is suggested that the efficiency of production could be raised by a major consolidation of the scattered strips of land, some collective farming in the cereal-growing areas of eartern Europe, cooperative use of small-size machinery, improved seed and livestock, and better housing. The peasant will look for the security of markets and prices that he has experienced in recent years, but without rigid government control.

The final two chapters outline the relationship between Europe and the rest of the world. There is obviously the short-run task in the nature of food-relief and the supply of the means of rehabilitating agriculture, but there is also the long-term problem of reconstruction. It is stressed that these two activities cannot be kept in separate compartments. On the other hand, if it is to be successful any change must be gradual, and the authors foresee the possibility of the retention of tariff walls in Europe for many years to come, and point out that it would be sheer folly to remove all import duties on the cessation of war. Any substantial programme for peasant welfare cannot be achieved in a year—rather will it take a generation. The book, although not providing the final plans for such a programme, clearly raises the issues, and as such provides an excellent basis for the careful thinking, which must of necessity be devoted to this important problem.

Book Reviews

INSECT PESTS AND THEIR CONTROL, by J. W. Evans.

(*Pp.* 178, *with* 104 *text figures. Department of Agriculture, Tasmania.* 1943. *Price* 2*s.* 6*d.*)

This book aims at giving concise information about the economic insects of Tasmania. It is primarily intended for those concerned with the growing of crops, on the farm, or in the orchard and garden ; but it is a readable book, which might well find a place on the bookshelf of anyone interested in the insect life of the countryside, and in country schools. There are about 200 different kinds of insects, in Tasmania, which may be classed as pests. The essential features of the life history and habits of many of them are given in this little volume, together with notes about how to control them. The information is largely based on the author's observations, made during a period of ten years' service with the Department of Agriculture. It is fairly complete for some species, according to the new knowledge contributed by the author ; less information appears to be available about other species.

A list of orders with brief notes on each order, given in Section V, helps the reader to appreciate the diversity of form in insect life. The list of orders follows the classification given in R. J. Tillyard's *Insects of Australia and New Zealand*, except that the Mecoptera and Neuroptera find a place next to the Hemiptera.

The author occasionally gives brief notes about particular members of the insect fauna of Tasmania of special interest to entomologists, indicating his wider acquaintance with insect life. We are reminded that *Apteropanorpa* is the only Panorpid recorded from the Australian region, and that the Cicada, *Tettigarda tomentosa*, has the rare feature of being without song.

Several examples are dealt with of parasites introduced into Tasmania to control particular insects ; and a short account is given of the introduction of the gorse weevil. These help the reader to get an idea of the significance of " biological control " in economic entomology. The book is illustrated by 104 good, original drawings. It fulfils admirably the aim of the author. Many of the insects dealt with occur in the southern States of Australia, so that the book will find a useful place outside Tasmania. It is good value at 2s. 6d.

JAMES DAVIDSON.

THE PRODUCTION OF SEED OF ROOT CROPS AND VEGETABLES.

(*Imperial Agricultural Bureaux Joint Publication No.* 5. 1943. *Price* 3*s. sterling.*)

This publication is an outline of the efforts made since 1939 by the principal countries of the free world to achieve self-sufficiency in vegetable seed supplies after having been isolated from the former seed-producing areas of central Europe. Most of the contributions are in the style of progress reports, detailing the extent to which various seeds can be produced and the best methods that so far have been adopted.

The story of the establishment of the sugar beet seed industry in U.S.A. is presented in great detail, from complete dependence in 1934 on overseas supplies of seed, to the establishment today of an entirely new industry quite capable of meeting all domestic needs. Planned research in which agronomists, plant breeders, physiologists and plant pathologists all cooperated was the basis of its successful development.

Sweden, a country on the fringe of the seed-producing latitudes, has perhaps the most progressive record over the last 30 years of all the seed-producing countries of the world. Detailed and extremely valuable information is presented in relation to this country's seed laws. To those interested in the problems associated with seed certification, the data on the operation of the State Central Seed Testing Station, the administration of " State-sealing " and " control cultivation " whereby rigorous supervision, inspection and control are exercised over the production of high quality seed, should provide valuable assistance.

Considerable development in seed production is reported from England, where the organization of the industry, its operation and the various controlling seed laws are outlined. In regard to Australia, New Zealand and Canada, each country appears to have a hopeful future in fulfilling its domestic requirements of seed, provided areas are chosen where conditions are suitable for growth, ripening and harvesting.

Perhaps the most provocative section of the publication is the contribution from U.S.A. under the sub-heading of " Some Special Problems ". Many of the seed-producing areas of America are similar in climatic conditions to those areas in Australia where we are attempting to produce vegetable seeds, thus providing the opportunity to review their problems in relation to our own efforts. The biggest difficulty at present is the high losses of mother roots of biennial crops from disease. Another difficulty is that there is little exact information on the minimum requirements of temperature and length of day for getting seed production on new areas. It has been found that high summer temperatures in irrigated areas have frequently interfered with pollination, and in the case of carrots maturation is frequently too rapid, interfering with germination and vitality.

Although there are many loopholes in our knowledge relating to seed production to which this publication cannot provide the answers, nevertheless to those interested in vegetable culture and seed production this publication should provide valuable assistance.

TEMPLE KIELY.

PLANTS AND VITAMINS, by W. H. Schopfer, authorised translation by Norbert L. Noecker.

(*Pp. xiv+293, 3 plates. Chronica Botanica Co., Waltham, Mass., U.S.A.; Angus and Robertson, Ltd., Sydney.* 1943. *Price* 4.75 *dollars.*)

This book is a valuable contribution from the new series of plant science books being published by Chronica Botanica. The author, whose work is well known in Europe, is well qualified for the task of bringing together in book form present knowledge in the new field of vitamins and plant growth. As W. J. Robbins states in a foreword, the fact that certain vitamins and other organic compounds in minute quantities are now known to be essential for the normal growth of plants was largely due to the pioneering work of Schopfer on the nutrition of fungi cultured on artificial media. In 1934 the author published results which showed that an external supply of thiamin is necessary for the growth of Phycomyces, and since then many workers have followed his lead.

The book is in the nature of a critical review of publications in this very new field and the large number of references at the ends of the twenty-four chapters testifies to the thoroughness of the author. The book is divided into three parts; the first covers the synthesis of vitamins in plants, a discussion of auxo-autotrophic plants and research methods; the second deals with vitamins in relation to plants unable to synthesize them and with growth factors of micro-organisms; the third, and most interesting section for the agriculturist, is entitled general problems involving vitamins. Although present knowledge is very limited, the chapters dealing with the bio-synthesis of vitamins will be of special interest to those concerned with human and animal nutrition.

The recognition of the importance of vitamins as growth factors for micro-organisms will greatly improve cultural techniques and may even make possible the artificial culture of the Erysiphales and the Uredinales. Avitaminosis in the complex multicellular animals and plants gives rise to complex symptoms but in simple cellular organisms the effect can only be reflected in the growth rate. From this has been developed a bio-assay for thiamin using Phycomyces and a bio-assay for nicotinic acid using *B. proteus.*

Of particular interest to the agriculturist is the short chapter dealing with the rôle of vitamins in the growth of crops. As the author states, "it can readily be expected that the soil acts on plants not only through its plastic foods and minerals but also through its growth factors . . . and the presence of growth factors in natural manures must contribute to their superiority as compared with artificial fertilizers."

Factors influencing the vitamin content of plants, particularly of the unstable Vitamin C, which is so important in human nutrition, are discussed. Although the vitamin content of a plant is a characteristic which is determined genetically, it may yet be possible to increase greatly the vitamin content of food plants by other means. Of practical interest in regard to the harvesting of vegetables is the very recent discovery that there is a diurnal variation in the Vitamin C content of plant leaves.

The presentation of semi-structural formulae for many of the compounds dealt with, the many references, and the provision of good author and subject indexes are valuable features of the book.

E. G. HALL.

PLANT VIRUSES AND VIRUS DISEASES, by F. C. Bawden.

(*Second Edition, 294 pages. Chronica Botanica Co., Waltham, Mass., U.S.A.; Angus and Robertson, Ltd., Sydney.* 1943. *Price* 4.75 *dollars.*)

When war came to Holland, the original print of this work was lost. The continued demand for the book led to a complete new printing being made in America, and the opportunity was taken by the author of completely revising the text and incorporating the results of recent research. This is not a textbook for those interested only in the field diagnosis and classification of virus diseases. The author, who is a member of the famous Rothamsted research station and an outstanding figure in the field of physico-chemical research on viruses, is interested in them *per se*, and the greater part of the book is devoted to discussion of their nature and behaviour. However, for any person interested in these entities from the point of view of their biological relationships and the possible light they throw on the origins of life (and what biologist or student of biology is not ?) the book should prove fascinating reading. Typical chapters are Symptomatology, Relationships between viruses and their insect vectors, Serological reactions of plant viruses, Methods of purification, Properties of purified virus preparations, and the Sizes of virus

particles. Short chapters are included dealing with the physiology of virus-diseased plants, with the classification of plant viruses and their control, and, finally, a discussion of their origin and multiplication. The author is to be commended for his refusal to enter the nomenclatorial tussle at present being staged amongst plant virologists. He is content to give an impartial view of all proposed systems of classification.

The book is a clear, easily readable account of all significant fundamental virus research that has been done to date, and each section is supported by a comprehensive bibliography. Much new material has been incorporated since the first edition and considerable rearrangement has taken place. The value of the book is increased by the inclusion of 48 plates (11 more than in the first edition), several of the added plates being very modern electron microscope photographs of actual virus particles. A comprehensive index and author index are also included. Only one error of any consequence, perpetuated from the first edition, was noted in the text. On page 16, line 19, it is stated that all American potato varieties carry Virus X. This is definitely not true of the new varieties introduced during the past ten years and which now make up a significant part of American potato crops.

The publishers are to be congratulated on the excellent quality of the book. The printing is clear, easily readable and free from typographical errors. The great care that has been given to every detail of production is evident in the way that several of the plates have been inserted since the first edition in order to present a more pleasing composition. The book is handsomely bound and finished.

Unquestionably, this volume will be a standard reference for many years to come for those interested in plant viruses.

D. Norris.

LECTURES ON THE INORGANIC NUTRITION OF PLANTS, by D. R. Hoagland.

(226 *pages. Chronica Botanica Co., Waltham, Mass., U.S.A. ; Angus and Robertson, Ltd., Sydney.* 1944. *Price* 4.00 *dollars.*)

This volume will be welcomed by all interested in plant nutrition. At the outset the author emphasizes that the book must be regarded as neither a monograph nor a text, but is intended " to present a general perspective of several important aspects of the field of plant nutrition with a broad interpretation of this field in mind ". He has succeeded in getting a great amount of material into a book of modest size.

For many years Professor Hoagland has himself been an active investigator in the field of plant nutrition and has contributed much to the advance of the subject. The matter contained in his book consists mainly of an account of the author's own experiments, or those of different groups of Californian workers with which he has had more or less direct contact. The volume is therefore authoritative and up to date, and contains a highly critical analysis of the results obtained. The trends of the latest research in the field of plant nutrition are described, and emphasis is placed on some of the problems which require further investigation. The presentation is concise and clear.

The book is comprised of seven lectures which were originally given at Harvard University under the Prather Lectureship. The titles of the lectures are as follow : A survey of problems of plant nutrition ; Micronutrient chemical elements and plant growth ; the absorption and accumulation of salts by plant cells ; Upward movement and distribution of organic solutes in the plant ; The growth of plants in artificial media in relation to the study of plant nutrition ; Some biochemical problems associated with salt absorption ; and Aspects of the potassium nutrition of plants as illustrating problems of the system, soil-water-atmosphere. Each lecture concludes with numerous references to the literature and the volume is supplied with general and author indexes. There are 49 text figures and tables, and an excellent series of 28 plates, supplied by several groups of workers, and including many not previously published.

C. R. Millikan.

Obituary

JAMES OSCAR HENRICK

It is with the deepest regret that we record the death on 5th November, 1943, of James Oscar Henrick, B.Sc.Agr., Plant Pathologist, Department of Agriculture, Tasmania, at the age of 54 years.

He was a native of Queensland, but later came to New South Wales and received his secondary education at St. Joseph's College, Hunter's Hill. He was successful in gaining one of the first "cadetships" (now called "traineeships") instituted by the New South Wales Department of Agriculture in 1909, and, with the late Captain H. Stephens, H. Wenholz and E. A. Southee, comprised the first group of students to pioneer the course for the degree in Agriculture at Sydney University, which was inaugurated in 1910. He graduated in 1913, and, after a period of practical and technical training at the experiment farms and departmental laboratories, was appointed to the position of Instructor in Agriculture, Hawkesbury Agricultural College, in November, 1915.

He enlisted in the A.I.F. in February, 1916, and attained the rank of Captain in the 23rd Machine Gun Company. In the Villers Bretonneux engagement he narrowly escaped death, being buried up to the neck by enemy shell fire. He spent some time convalescing from shell shock, which left him with a permanent affliction of the heart.

At the conclusion of hostilities he assisted in the organization of an agricultural education scheme for the troops as Chief Instructor, 3rd Divisional School for Agriculture.

He resumed his former position at the College in July, 1919. Enthusiastic and effective in his instructional work and of genial and courteous personality, J. O. appealed to staff and students alike. He held the College position until January, 1928, when he left to accept an appointment in the newly organized Tasmanian Department of Agriculture.

Among the positions which he held in Tasmania were those of District Agricultural Officer for the North-west Coast and later, in 1931, for the South-east and part of the Southern districts. On the retirement of Dr. Dowson as Plant Pathologist, Mr. Henrick was appointed to the position, which he held until his retirement in 1943, owing to ill-health.

Our deepest sympathy is extended to his widow and daughter.

Personal Notes

Flight-Sergeant P. W. B. Gurdon (R.A.A.F.) has been reported missing in air operations overseas.

Mr. A. F. Bell has been appointed a member of the Bureau of Investigation constituted under the Queensland Land and Water Resources Development Act, 1943.

Captain R. T. M. Pescott, who has been attached to the Entomological Branch of the Australian Army, has been appointed Director of the National Museum, Melbourne. Captain Pescott was formerly Entomologist to the Victorian Department of Agriculture.

Captain G. Duncan has been released from the army to take up his original appointment with the Victorian Department of Agriculture. He is working on irrigated pasture problems at the State Research Farm, Werribee.

Mr. R. D. Croll, who had been on loan from the Department of Agriculture to the Commonwealth Department of Labour and National Service, has accepted an executive position with Drug Houses of Australia, Ltd., Sydney.

Dr. C. S. Piper has been appointed as part-time Senior Research Officer in the C.S.I.R. Division of Soils. He is in charge of the section of Soil Chemistry at the Waite Institute.

Mr. E. J. Breakwell has been released from the Army to resume work at Roseworthy Agricultural College.

Mr. D. C. Wark has been appointed to the C.S.I.R. Division of Plant Industry. He will transfer to Canberra on 1st July and will be engaged on vegetable production.

Mr. R. G. Downes, of the C.S.I.R. Division of Soils, has transferred to Victoria, where he will undertake a soil erosion survey in the Dookie-Benalla area in collaboration with the Victorian Soil Conservation Board. His headquarters will be at the School of Agriculture, University of Melbourne.

After three years' active service with the R.A.A.F., Mr. M. O'Reilly has returned to the N.S.W. Department of Agriculture and is at present Chairman of the Windsor District War Agricultural Committee.

Mr. J. Carroll has been released from the Army to resume his former work at New England Experiment Farm in the N.S.W. Department of Agriculture.